Rec'd PCT/PTO 07 DEC 2004 10/517104

LATE TRANSITION METAL CATALYSTS FOR OLEFIN POLYMERIZATION AND OLIGOMERIZATION

Field

A series of novel late transition metal catalysts for olefin polymerization have been invented. The Group 10 transition metal species are characterized by their typical pseudo-square planar geometry and diamagnetism. These late transition metal catalysts demonstrate high activity for α-olefin polymerization.

Background

Early transition metal catalysts useful for olefin coordination polymerization include the traditional Ziegler-type catalysts based on Group-4-5 transition metals and the newer metallocene type catalysts based on Group-4-6 transition metals. But specific late transition metal catalysts suitable for olefin polymerization have not offered the same levels of activity or molecular weight capability for olefin polymerization. Further development of these catalyst systems has been attempted addressing these shortcomings.

Ancillary-ligand-stabilized metal complexes (e.g., organometallic complexes) are typically useful as catalysts, additives, stoichiometric reagents, monomers, solid state precursors, therapeutic reagents, and drugs. The ancillary ligand system generally comprises organic substituents that connect to and remain associated with the metal centers. These interactions provide an opportunity to modify the organometallic complexes' shape and their electronic and chemical properties.

Certain organometallic complexes are catalysts for reactions such as oxidation, reduction, hydrogenation, hydrosilation, hydrocyanation, hydroformylation, polymerization, carbonylation, isomerization, metathesis, carbon-hydrogen activation, cross-coupling, Friedel-Crafts acylation and alkylation, hydration, dimerization, trimerization, oligomerization, Diels-Alder reactions, and other transformations. Typical complex synthesis proceeds by combining an ancillary ligand precursor with a metal-containing precursor in a solvent at a temperature. For example, organometallic complexes can be single-site, olefin polymerization catalysts. Their active sites typically comprise an ancillary-ligand-stabilized, coordinatively unsaturated transition-metal-alkyl complex.

In Johnson, Killian, and Brookhart, *J. Am. Chem. Soc.*, **1995**, *117*, 6414, the authors describe the use of Ni and Pd complexes for ethylene, propylene, and 1-hexene homopolymerization. The catalyst precursors are square-planar, M^{2+}, d^8, 16-electron complexes incorporating substituted, bidentate diimine ligands. Either methyl or bromide ligands occupy the active coordination sites. These polymerizations used $H^+(OEt_2)_2[B(3,5-(CF_3)_2C_6H_3)_4]^-$ to activate methyl ligand complexes and methylalumoxane (MAO) or diethyl aluminum chloride to activate bromide ligand complexes.

European Patent publication EP-A2-0 454 231 describes Group-8, -9, and -10 metal catalysts as being suitable for ethylene, α-olefin, diolefin, functionalized olefin, and alkyne polymerizations. The catalyst precursors are Group-8, -9, and -10 metal compounds that are activated by cocatalysts including discrete borate anions. This paper also illustrates ethylene homopolymerization in solutions of methylene chloride, toluene and diethyl ether. Few polymerizations were conducted in the presence of a support material, and broad molecular weight distribution polymers were produced.

WO 97/48736 describes supported late transition metal catalysts based on diimine nickel dihalide compounds where the transition metal complex was preactivated with an alumoxane.

PCT publication WO 99/05154 relates to a variety of pnictide-based ligands and their uses for catalyst systems. In particular, it discloses metal compositions and compounds stabilized by an ancillary chelating ligand structure, that polymerize functionalized and non-functionalized monomers, either alone or with an activator.

Other references of interest include US 6,586,358 B2, V. C. Gibson and S. K. Spitzmesser, *Chem. Rev.*, **2003**, 103, 283, and S. D. Ittel, L. K. Johnson, and M. Brookhart, *Chem. Rev.*, **2000**, *100*, 1169.

With the discoveries of Brookhart and others, a new area of focus in polymerization catalysis now focuses on late transition metal chemistry. These types of catalyst precursors are typically nickel, cobalt or iron dihalide compounds complexed with bidentate or tridentate chelating ligands. These types of nickel catalyst precursors are typically only slightly soluble in commonplace polymerization solvents. The nickel complexes are also typically

paramagnetic complexes that are difficult to characterize and purify. Depending on the oxidation state of the cobalt and iron complexes, they too can be paramagnetic. When complexes are paramagnetic, typically IR, elemental analysis and x-ray crystallography characterization is useful, however, these techniques can also be limiting. For example, for x-ray crystallography, growing crystals of fairly insoluble compounds can often be difficult. Elemental analysis requires a pure compound, again something often difficult to obtain with a poorly soluble compound because purification techniques are more limited. And while IR is a good characterization tool when used in combination with other characterization techniques, it also has its limitations – in particular, identifying and quantifying small amounts of impurities in a product. Thus, the need exists for more easily characterized and more soluble catalyst precursors that nonetheless retain or exceed the catalytic activity of prior art catalysts.

Summary

The polymerization catalysts of this invention can be derived from the transition metal compounds (also called precatalysts or catalyst precursors) of formula: LMX wherein M is a Group 3 to 11 metal, preferably a Group 8, 9, 10 or 11 metal; L is a bulky bidentate or tridentate neutral ligand that is bonded to M by two or three heteroatoms and at least one heteroatom is nitrogen; X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality.

Preferred transition metal compounds are typically complexes stabilized in a pseudo square planar geometry that provides a diamagnetic complex that can be readily characterized by NMR spectroscopy. Furthermore, in this geometry, the catalyst precursor is more soluble in common organic solvents.

This invention further relates to a process to oligomerize and/or polymerize unsaturated monomers using the above transition metal compounds combined with an activator.

Definitions

As used herein, the numbering scheme for the Periodic Table Groups is used as in CHEMICAL AND ENGINEERING NEWS, 63(5), 27 (1985).

The terms "hydrocarbyl radical," "hydrocarbyl" and hydrocarbyl group" are used interchangeably throughout this document. Likewise the terms "group" and "substituent" are also used interchangeably in this document. For purposes of this disclosure, "hydrocarbyl radical" is defined to be C_1-C_{100} radicals, that may be linear, branched, or cyclic, and when cyclic, aromatic or non-aromatic, and include substituted hydrocarbyl radicals, halocarbyl radicals, and substituted halocarbyl radicals, silylcarbyl radicals, and germylcarbyl radicals as these terms are defined below.

Substituted hydrocarbyl radicals are radicals in which at least one hydrogen atom has been substituted with at least one functional group such as NR^5_2, OR^5, SeR^5, TeR^5, PR^5_2, AsR^5_2, SbR^5_2, SR^5, BR^5_2, SiR^5_3, GeR^5_3, SnR^5_3, PbR^5_3 and the like or where at least one non-hydrocarbon atom or group has been inserted within the hydrocarbyl radical, such as O, S, Se, Te, NR^5, PR^5, AsR^5, SbR^5, BR^5, SiR^5_2, GeR^5_2, $SnR^{5\prime}_2$, PbR^5_2 and the like, where R^5 is independently a hydrocarbyl or halocarbyl radical. In some embodiments of the invention, a substituted hydrocarbyl excludes substitutions with trihydrocarbylsiloxy substituents, e.g. –$OSiR^5_3$.

Halocarbyl radicals are radicals in which one or more hydrocarbyl hydrogen atoms have been substituted with at least one halogen (e.g. F, Cl, Br, I) or halogen-containing group (e.g. CF_3).

Substituted halocarbyl radicals are radicals in which at least one halocarbyl hydrogen or halogen atom has been substituted with at least one functional group such as NR^5_2, OR^5, SeR^5, TeR^5, PR^5_2, AsR^5_2, SbR^5_2, SR^5, BR^5_2, SiR^5_3, GeR^5_3, SnR^5_3, PbR^5_3 and the like or where at least one non-carbon atom or group has been inserted within the halocarbyl radical such as O, S, Se, Te, NR^5, PR^5, AsR^5, SbR^5, BR^5, SiR^5_2, GeR^5_2, SnR^5_2, PbR^5_2 and the like where R^5 is independently a hydrocarbyl or halocarbyl radical provided that at least one halogen atom remains on the original halocarbyl radical.

Silylcarbyl radicals (also called silylcarbyls) are groups in which the silyl functionality is bonded directly to the indicated atom or atoms. Examples include SiH_3, SiH_2R^5, $SiHR^5_2$, SiR^5_3, $SiH_2(OR^5)$, $SiH(OR^5)_2$, $Si(OR^5)_3$, $SiH_2(NR^5_2)$, $SiH(NR^5_2)_2$, $Si(NR^5_2)_3$, and the like where R^5 is independently a hydrocarbyl or halocarbyl radical as defined above and two or more R^5 may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure. Germylcarbyl radicals (also called germylcarbyls) are groups in which the germyl functionality is bonded directly to

the indicated atom or atoms. Examples include GeH_3, GeH_2R^5, $GeHR^5_2$, GeR^5_3, $GeH_2(OR^5)$, $GeH(OR^5)_2$, $Ge(OR^5)_3$, $GeH_2(NR^5_2)$, $GeH(NR^5_2)_2$, $Ge(NR^5_2)_3$, and the like where R^5 is independently a hydrocarbyl or halocarbyl radical as defined above and two or more R^5 may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

Polar radicals or polar groups are groups in which the heteroatom functionality is bonded directly to the indicated atom or atoms. They include heteroatoms of groups 1-17 of the periodic table either alone or connected to other elements by covalent or other interactions such as ionic, van der Waals forces, or hydrogen bonding. Examples of functional groups include carboxylic acid, acid halide, carboxylic ester, carboxylic salt, carboxylic anhydride, aldehyde and their chalcogen (Group 14) analogues, alcohol and phenol, ether, peroxide and hydroperoxide, carboxylic amide, hydrazide and imide, amidine and other nitrogen analogues of amides, nitrile, amine and imine, azo, nitro, other nitrogen compounds, sulfur acids, selenium acids, thiols, sulfides, sulfoxides, sulfones, phosphines, phosphates, other phosphorus compounds, silanes, boranes, borates, alanes, aluminates. Functional groups may also be taken broadly to include organic polymer supports or inorganic support material such as alumina, and silica. . Preferred examples of polar groups include NR^5_2, OR^5, SeR^5, TeR^5, PR^5_2, AsR^5_2, SbR^5_2, SR^5, BR^5_2, SnR^5_3, PbR^5_3 and the like where R^5 is independently a hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl radical as defined above and two R^5 may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

In some embodiments, the hydrocarbyl radical is independently selected from methyl, ethyl, ethenyl and isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl. Also

included are isomers of saturated, partially unsaturated and aromatic cyclic structures wherein the radical may additionally be subjected to the types of substitutions described above. Examples include phenyl, methylphenyl, benzyl, methylbenzyl, naphthyl, cyclohexyl, cyclohexenyl, methylcyclohexyl, and the like. For this disclosure, when a radical is listed, it indicates that radical type and all other radicals formed when that radical type is subjected to the substitutions defined above. Alkyl, alkenyl and alkynyl radicals listed include all isomers including where appropriate cyclic isomers, for example, butyl includes *n*-butyl, 2-methylpropyl, 1-methylpropyl, *tert*-butyl, and cyclobutyl (and analogous substituted cyclopropyls); pentyl includes n-pentyl, cyclopentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, 1-ethylpropyl, and neopentyl (and analogous substituted cyclobutyls and cyclopropyls); butenyl includes E and Z forms of 1-butenyl, 2-butenyl, 3-butenyl, 1-methyl-1-propenyl, 1-methyl-2-propenyl, 2-methyl-1-propenyl and 2-methyl-2-propenyl (and cyclobutenyls and cyclopropenyls). Cyclic compound having substitutions include all isomer forms, for example, methylphenyl would include ortho-methylphenyl, meta-methylphenyl and para-methylphenyl; dimethylphenyl would include 2,3-dimethylphenyl, 2,4-dimethylphenyl, 2,5-dimethylphenyl, 2,6-diphenylmethyl, 3,4-dimethylphenyl, and 3,5-dimethylphenyl.

A "bulky ____-carbyl" (such as a bulky hydrocarbyl or a bulky halocarbyl) is one comprising three or more carbon atoms.

A neutral ligand is a ligand that bonds to the metal atom, M, through one or more dative or coordinative bonds.

For purposes of this disclosure, the terms "catecholate" and "catecholate ligand" are defined to be a ligand comprising a phenyl ring with two oxygen atoms connected to the phenyl ring at the ring's 1 and 2 positions. The ligand connects to the metal center of the catalyst precursor through both of these oxygen atoms. This leaves four hydrogen atoms connected to the phenyl ring at its 3, 4, 5 and 6 positions. Zero, one, two, three, or four of these hydrogen atoms can independently be substituted with a hydrocarbyl radical, preferably a C_1-C_{50}. Also, adjacent catecholate hydrocarbyl radicals can join to transform the catecholate into a substituted or unsubstituted, fused-multi-ring system.

In the context of this document, "homopolymerization" would produce a polymer made from one monomer. For example, homopolymerization of propylene would produce

homopolypropylene, also called polypropylene. Homopolymerization of ethylene would produce homopolyethylene, also called polyethylene. It should be noted, however, that some of the catalysts of this invention homopolymerize ethylene or propylene to non-traditional "polyethylene" and "polypropylene" structures, respectively. Likewise, "copolymerization" would produce polymers with more than one monomer type. For example, ethylene copolymers include polymers of ethylene with α-olefins, cyclic olefins and diolefins, vinylaromatic olefins, α-olefinic diolefins, substituted α-olefins, and/or acetylenically unsaturated monomers. Non-limiting examples of α-olefins include propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, 1-decene, 1-undecene 1-dodecene, 1-tridecene, 1-tetradecene, 1-pentadecene, 1-hexadecene, 1-heptadecene, 1-octadecene, 1-nonadecene, 1-eicosene, 1-heneicosene, 1-docosene, 1-tricosene, 1-tetracosene, 1-pentacosene, 1-hexacosene, 1-heptacosene, 1-octacosene, 1-nonacosene, 1-triacontene, 4-methyl-1-pentene, 3-methyl-1-pentene, 5-methyl-1-nonene, 3,5,5-trimethyl-1-hexene, vinylcyclohexane, and vinylnorbornane. Non-limiting examples of cyclic olefins and diolefins include cyclobutene, cyclopentene, cyclohexene, cycloheptene, cyclooctene, cyclononene, cyclodecene, norbornene, 4-methylnorbornene, 2-methylcyclopentene, 4-methylcyclopentene, vinylcyclohexane, norbornadiene, dicyclopentadiene, 5-ethylidene-2-norbornene, vinylcyclohexene, 5-vinyl-2-norbornene, 1,3-divinylcyclopentane, 1,2-divinylcyclohexane, 1,3-divinylcyclohexane, 1,4-divinylcyclohexane, 1,5-divinylcyclooctane, 1-allyl-4-vinylcyclohexane, 1,4-diallylcyclohexane, 1-allyl-5-vinylcyclooctane, and 1,5-diallylcyclooctane. Non-limiting examples of vinylaromatic olefins include styrene, *para*-methylstyrene, *para*-t-butylstyrene, vinylnaphthylene, vinyltoluene, and divinylbenzene. Non-limiting examples of α-olefinic dienes include 1,4-hexadiene, 1,5-hexadiene, 1,5-heptadiene, 1,6-heptadiene, 6-methyl-1,6-heptadiene, 1,7-octadiene, 7-methyl-1,7-octadiene, 1,9-decadiene, 1,11-dodecene, 1,13-tetradecene and 9-methyl-1,9-decadiene. Substituted α-olefins (also called functional group containing α-olefins) include those containing at least one non-carbon Group 13 to 17 atom bound to a carbon atom of the substituted α-olefin where such substitution if silicon may be adjacent to the double bond or terminal to the double bond, or anywhere in between, and where inclusion of non-carbon and –silicon atoms such as for example B, O, S, Se, Te, N, P, Ge, Sn, Pb, As, F, Cl, Br, or I, are contemplated, where such non-carbon or –silicon moieties are sufficiently far removed from the double bond so as not to interfere with the coordination polymerization reaction with the catalyst and so to retain the generally hydrocarbyl characteristic. By sufficiently far removed from the

double bond we intend that the number of carbon atoms, or the number of carbon and silicon atoms, separating the double bond and the non-carbon or –silicon moiety may be 6 or greater, e.g. 7, or 8, or 9, or 10, or 11, or 12, or 13, or 14 or more. The number of such carbon atoms, or carbon and silicon atoms, is counted from immediately adjacent to the double bond to immediately adjacent to the non-carbon or –silicon moiety. Examples include allyltrimethylsilane, divinylsilane, 8,8,8-trifluoro-1-octene, 8-methoxyoct-1-ene, 8-methylsulfanyloct-1-ene, 8-dimethylaminooct-1-ene, or combinations thereof. The use of functional group-containing α-olefins where the functional group is closer to the double bond is also within the scope of embodiments of the invention when such olefins may be incorporated in the same manner as are their α-olefin analogs. See, "Metallocene Catalysts and Borane Reagents in The Block/Graft Reactions of Polyolefins", T.C. Chung, *et al*, *Polym. Mater. Sci. Eng.*, v. 73, p. 463 (1995), and the masked α-olefin monomers of US 5,153,282. Such monomers permit the preparation of both functional-group containing copolymers capable of subsequent derivatization, and of functional macromers which may be used as graft and block type polymeric segments. All documents cited herein are incorporated by reference for purposes of all jurisdictions where such practice is allowed. Copolymerization can also incorporate α-olefinic macromonomers of up to 2000 mer units.

For purposes of this disclosure, the term oligomer refers to compositions having 2-75 mer units and the term polymer refers to compositions having 76 or more mer units. A mer is defined as a unit of an oligomer or polymer that originally corresponded to the olefin(s) used in the oligomerization or polymerization reaction. For example, the mer of polyethylene would be ethylene.

In some structures throughout this specification, the ligand-metal connection is drawn with an arrow indicating that the electrons for the bond originally came from the ligand. At other times, a solid line showing the bond's covalent nature represents the ligand-metal connection. One of ordinary skill in the art recognizes that these depictions are interchangeable.

The term "catalyst system" is defined to mean a catalyst precursor/activator pair. When "catalyst system" is used to describe such a pair before activation, it means the unactivated catalyst (precatalyst) together with an activator and, optionally, a co-activator.

When it is used to describe such a pair after activation, it means the activated catalyst and the activator or other charge-balancing moiety.

The transition metal compound may be neutral as in a precatalyst, or a charged species with a counter ion as in an activated catalyst system.

Catalyst precursor is also often referred to as precatalyst, catalyst, catalyst precursor and transition metal compound or complex. These words are used interchangeably. Activator and cocatalyst are also used interchangeably. A scavenger is a compound that is typically added to facilitate oligomerization or polymerization by scavenging impurities. Some scavengers may also act as activators and may be referred to as co-activators. A co-activator, that is not a scavenger, may also be used in conjunction with an activator in order to form an active catalyst. In some embodiments a co-activator can be pre-mixed with the transition metal compound to form an alkylated transition metal compound, also referred to as an alkylated invention compound.

Noncoordinating anion (NCA) is defined to mean an anion either that does not coordinate to the catalyst metal cation or that does coordinate to the metal cation, but only weakly. An NCA coordinates weakly enough that a neutral Lewis base, such as an olefinically or acetylenically unsaturated monomer can displace it from the catalyst center. Any metal or metalloid that can form a compatible, weakly coordinating complex may be used or contained in the noncoordinating anion. Suitable metals include, but are not limited to, aluminum, gold, and platinum. Suitable metalloids include, but are not limited to, boron, aluminum, phosphorus, and silicon.

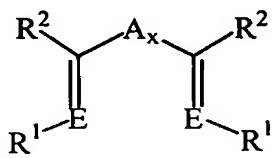
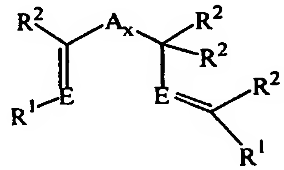
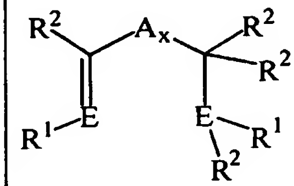
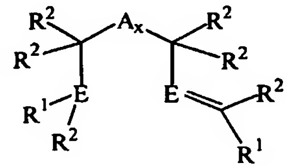
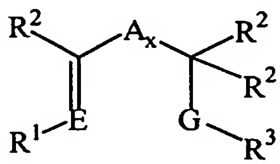
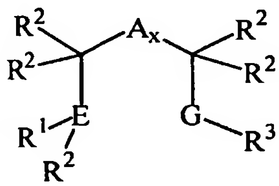
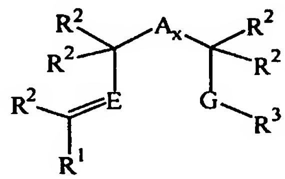
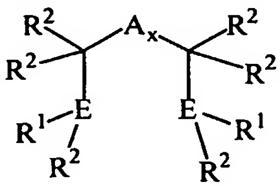
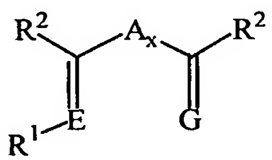
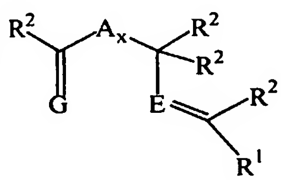
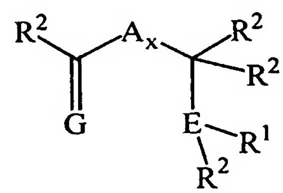
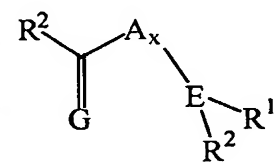
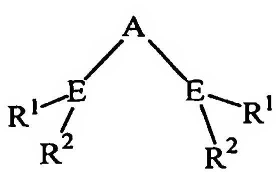
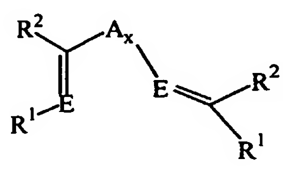
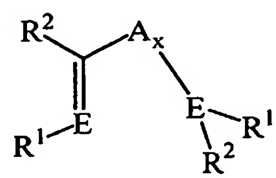
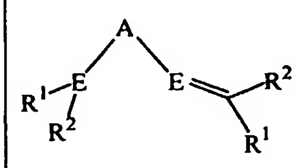
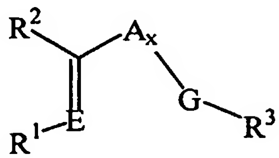
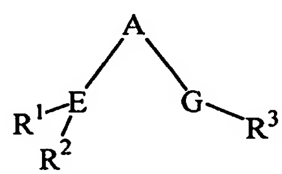
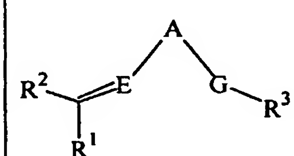
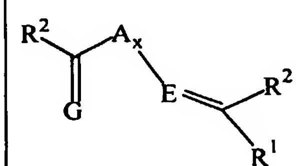
A stoichiometric activator can be either neutral or ionic. The terms ionic activator, and stoichiometric ionic activator can be used interchangeably. Likewise, the terms neutral stoichiometric activator, and Lewis acid activator can be used interchangeably.

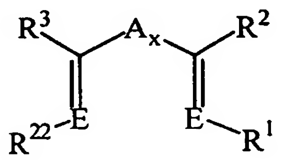
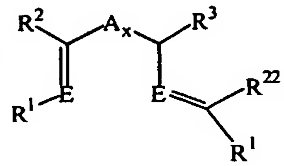
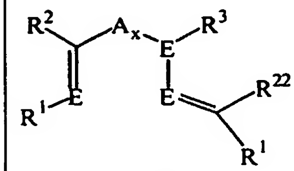
Detailed Description of the Invention

The polymerization catalysts of this invention can be derived from the transition metal compounds (precatalyst) of formula: LMX wherein M is a Group 3 to 11 metal, preferably a Group 8, 9, 10 or 11 metal; L is a bulky bidentate or tridentate neutral ligand that is bonded to M by two or three heteroatoms and at least one heteroatom is nitrogen; X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality.

A bulky bidentate or tridentate neutral ligand is one that is large enough such that one L ligand and one X ligand fill the coordination sphere about M, but excludes L ligands that are substituted and unsubstituted 2,2'-bipyridyl, 2,2'-biquinolinyl, 2,2'-bipyrazinyl, 1,10-phenanthroline, dipyridin-2-yl-amine, dipyridin-2-yl-methane, N^1-(2-amino-ethyl)ethane-1,2-diamine, N^1-(3-amino-propyl)propane-1,3-diamine, ethane-1,2-diamine, propane-1,3-diamine, cyclohexane-1,2-diamine, *N,N,N',N'*-tetramethylethane-1,2-diamine, methyl-(2-methyliminoethylidene)amine, *N,N'*-bis(napthalen-1-ylmethylene)ethane-1,2-diamine, *N,N'*-bis(napthalen-1-ylmethylene)propane-1,3-diamine, *N,N'*-dibenzylidene-propane-1,3-diamine, N^1-napthalen-1-ylmethylene-ethane-1,2-diamine, 2-[(3-amino-propylimino)methyl]phenol, 2,4,4-trimethyl-1,5,9-triaza-cyclododec-1-ene, 1,4,7-trimethyl-[1,4,7]triazonane, [2,2';6'2"]terpyridine, *N*-[2-dimethylaminoethyl)-*N,N',N'*-trimethylethane-1,2-diamine, cyclopenta[2,1-*b*;3,4-*b*']dipyridin-5-one, 2-(2-pyridylsulfanyl)pyridine, 2-(2-pyridyloxy)pyridine, benzyl-bis(pyridin-2-ylmethyl)amine, 2-pyridin-2-yl-quinoxaline, N^1-ethylidene-ethane-1,2-diamine, and bis(1*H*-benzoimidazol-2-ylmethyl)amine where substitution refers to replacing one or more existing hydrogen atoms bonded to carbon with another atom or group of atoms. Also excluded are 1,4-diaza-1,3-butadiene ligands containing substituents in the 2 and or 3 positions containing trihydrocarbylsiloxy groups.

The bulky bidentate or tridentate ligand, L, may be represented by the following formulae:

 L1	 L2	 L3	 L4
 L5	 L6	 L7	 L8
 L9	 L10	 L11	 L12
 L13	 L14	 L15	 L16
 L17	 L18	 L19	 L20

 L21	 L22	 L23	

where E is, independently, a Group 15 element that is bonded to M, and each L must have one E that is nitrogen; G is a Group 16 element that is bonded to M; A is a bridging group containing a Group 13-16 element and an atom within A may optionally be bonded to M; x is 0 or 1 meaning that when x is 1, A is present and when x is zero, A represents a bond between two atoms; R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$); R^3 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, or R^3 is a substituted hydrocarbyl group containing a heteroatom or silicon atom directly bonded to G, E or the indicated carbon atom; R^{22} is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$); R^1, R^2 and/or R^3 groups on the same atom, adjacent atoms or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure provided that for L1, both pair of R^1 and R^2 do not join to form a substituted or unsubstituted pyridine, pyrazine, pyrimidine or benzimidazole ring; R^{22} and R^3 may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic heterocyclic ring structure provided that for L21 and L22, R^1 and R^2 do not join to form a substituted or unsubstituted pyridine, pyrazine, pyrimidine or benzimidazole ring; and two R^2 bonded to the same atom together may form an –one (=O), a thione (=S), an –imine (=NR'''), or a –carbene (=CR'''$_2$) group where R''' is, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl and two or more R''' on the same carbon may

join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

A bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl substituent is a group comprising 3 to 100 carbon atoms that imparts steric bulk on L such that one L ligand and one X ligand fill the coordination sphere of M. Non-limiting examples include all isomers and hydrocarbyl substituted isomers of C_3-C_{100} hydrocarbyl radicals including propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl; halocarbyl radicals and all isomers of halocarbyl radicals including perfluoropropyl, perfluorobutyl, perfluoropentyl, perfluorohexyl, perfluoroheptyl, perfluorooctyl, perfluorononyl, perfluorodecyl, perfluoroundecyl, perfluorododecyl, perfluorotridecyl, perfluorotetradecyl, perfluoropentadecyl, perfluorohexadecyl, perfluoroheptadecyl, perfluorooctadecyl, perfluorononadecyl, perfluoroeicosyl, perfluoroheneicosyl, perfluorodocosyl, perfluorotricosyl, perfluorotetracosyl, perfluoropentacosyl, perfluorohexacosyl, perfluoroheptacosyl, perfluorooctacosyl, perfluorononacosyl, perfluorotriacontyl, perfluorobutenyl, perfluorobutynyl, fluoropropyl, fluorobutyl, fluoropentyl, fluorohexyl, fluoroheptyl, fluorooctyl, fluorononyl, fluorodecyl, fluoroundecyl, fluorododecyl, fluorotridecyl, fluorotetradecyl, fluoropentadecyl, fluorohexadecyl, fluoroheptadecyl, fluorooctadecyl, fluorononadecyl, fluoroeicosyl, fluoroheneicosyl, fluorodocosyl, fluorotricosyl, fluorotetracosyl, fluoropentacosyl, fluorohexacosyl, fluoroheptacosyl, fluorooctacosyl, fluorononacosyl, fluorotriacontyl, difluorobutyl,

trifluorobutyl, tetrafluorobutyl, pentafluorobutyl, hexafluorobutyl, heptafluorobutyl, octafluorobutyl; substituted hydrocarbyl radicals and all isomers of substituted hydrocarbyl radicals including methoxypropyl, methoxybutyl, methoxypentyl, methoxyhexyl, methoxyheptyl, methoxyoctyl, methoxynonyl, methoxydecyl, methoxyundecyl, methoxydodecyl, methoxytridecyl, methoxytetradecyl, methoxypentadecyl, methoxyhexadecyl, methoxyheptadecyl, methoxyoctadecyl, methoxynonadecyl, methoxyeicosyl, methoxyheneicosyl, methoxydocosyl, methoxytricosyl, methoxytetracosyl, methoxypentacosyl, methoxyhexacosyl, methoxyheptacosyl, methoxyoctacosyl, methoxynonacosyl, methoxytriacontyl, butoxypropyl, butoxybutyl, butoxypentyl, butoxyhexyl, butoxyheptyl, butoxyoctyl, butoxynonyl, butoxydecyl, butoxyundecyl, butoxydodecyl, butoxytridecyl, butoxytetradecyl, butoxypentadecyl, butoxyhexadecyl, butoxyheptadecyl, butoxyoctadecyl, butoxynonadecyl, butoxyeicosyl, butoxyheneicosyl, butoxydocosyl, butoxytricosyl, butoxytetracosyl, butoxypentacosyl, butoxyhexacosyl, butoxyheptacosyl, butoxyoctacosyl, butoxynonacosyl, butoxytriacontyl, dimethylaminopropyl, dimethylaminobutyl, dimethylaminopentyl, dimethylaminohexyl, dimethylaminoheptyl, dimethylaminooctyl, dimethylaminononyl, dimethylaminodecyl, dimethylaminoundecyl, dimethylaminododecyl, dimethylaminotridecyl, dimethylaminotetradecyl, dimethylaminopentadecyl, dimethylaminohexadecyl, dimethylaminoheptadecyl, dimethylaminooctadecyl, dimethylaminononadecyl, dimethylaminoeicosyl, dimethylaminoheneicosyl, dimethylaminodocosyl, dimethylaminotricosyl, dimethylaminotetracosyl, dimethylaminopentacosyl, dimethylaminohexacosyl, dimethylaminoheptacosyl, dimethylaminooctacosyl, dimethylaminononacosyl, dimethylaminotriacontyl, trimethylsilylpropyl, trimethylsilylbutyl, trimethylsilylpentyl, trimethylsilylhexyl, trimethylsilylheptyl, trimethylsilyloctyl, trimethylsilylnonyl, trimethylsilyldecyl, trimethylsilylundecyl, trimethylsilyldodecyl, trimethylsilyltridecyl, trimethylsilyltetradecyl, trimethylsilylpentadecyl, trimethylsilylhexadecyl, trimethylsilylheptadecyl, trimethylsilyloctadecyl, trimethylsilylnonadecyl, trimethylsilyleicosyl, trimethylsilylheneicosyl, trimethylsilyldocosyl, trimethylsilyltricosyl, trimethylsilyltetracosyl, trimethylsilylpentacosyl, trimethylsilylhexacosyl, trimethylsilylheptacosyl, trimethylsilyloctacosyl, trimethylsilylnonacosyl, trimethylsilyltriacontyl and the like;

phenyl, and all isomers of hydrocarbyl substituted phenyl including methylphenyl, dimethylphenyl, trimethylphenyl, tetramethylphenyl, pentamethylphenyl ethylphenyl, diethylphenyl, triethylphenyl, tetraethylphenyl, pentaethylphenyl, propylphenyl, dipropylphenyl, tripropylphenyl, tetrapropylphenyl, pentapropylphenyl butylphenyl, dibutylphenyl, tributylphenyl, tetrabutylphenyl, pentabutylphenyl, hexylphenyl, dihexylphenyl, trihexylphenyl, tetrahexylphenyl, pentahexylphenyl, dimethylethylphenyl, dimethylpropylphenyl, dimethylbutylphenyl, dimethylpentylphenyl, dimethylhexylphenyl, diethylmethylphenyl, diethylpropylphenyl, diethylbutylphenyl, diethylpentylphenyl, diethylhexylphenyl, dipropylmethylphenyl, dipropylethylphenyl, dipropylbutylphenyl, dipropylpentylphenyl, dipropylhexylphenyl, dibutylmethylphenyl, dibutylethylphenyl, dibutylpropylphenyl, dibutylpentylphenyl, dibutylhexylphenyl, methylethylphenyl, methylpropylphenyl, methylbutylphenyl, methylpentylphenyl, methylhexylphenyl, ethylpropylphenyl, ethylbutylphenyl, ethylpentylphenyl, ethylhexylphenyl, propylbutylphenyl, propylpentylphenyl, propylhexylphenyl, butylpentylphenyl, butylhexylphenyl, methoxyphenyl, ethoxyphenyl, propoxyphenyl, butoxyphenyl, pentoxyphenyl, hexoxyphenyl, dimethoxyphenyl, phenoxyphenyl, methylmethoxyphenyl, dimethylaminophenyl, dipropylaminophenyl, bis(dimethylamino)phenyl, methyl(dimethylamino)phenyl, trimethylsilylphenyl, trimethylgermylphenyl, trifluoromethylphenyl, bis(triflouromethyl)phenyl, trifluoromethoxyphenyl and the like; all isomers of halo substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halophenyl, dihalophenyl, trihalophenyl, tetrahalophenyl, and pentahalophenyl; all isomers of halo substituted hydrocarbyl substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halomethylphenyl, dihalomethylphenyl, trihalomethylphenyl, tetrahalomethylphenyl, haloethlyphenyl, dihaloethylphenyl, trihaloethylphenyl, tetrahaloethylphenyl, halopropylphenyl, dihalopropylphenyl, trihalopropylphenyl, tetrahalopropylphenyl, halobutylphenyl, dihalobutylphenyl, trihalobutylphenyl, tetrahalobutylphenyl, dihalodimethylphenyl, dihalo(trifluoromethyl)phenyl and the like; all isomers of benzyl, and all isomers of hydrocarbyl substituted benzyl including methylbenzyl, dimethylbenzyl, trimethylbenzyl, tetramethylbenzyl, pentamethylbenzyl ethylbenzyl, diethylbenzyl, triethylbenzyl, tetraethylbenzyl, pentaethylbenzyl, propylbenzyl, dipropylbenzyl,

tripropylbenzyl, tetrapropylbenzyl, pentapropylbenzyl butylbenzyl, dibutylbenzyl, tributylbenzyl, tetrabutylbenzyl, pentabutylbenzyl, hexylbenzyl, dihexylbenzyl, trihexylbenzyl, tetrahexylbenzyl, pentahexylbenzyl, dimethylethylbenzyl, dimethylpropylbenzyl, dimethylbutylbenzyl, dimethylpentylbenzyl, dimethylhexylbenzyl, diethylmethylbenzyl, diethylpropylbenzyl, diethylbutylbenzyl, diethylpentylbenzyl, diethylhexylbenzyl, dipropylmethylbenzyl, dipropylethylbenzyl, dipropylbutylbenzyl, dipropylpentylbenzyl, dipropylhexylbenzyl, dibutylmethylbenzyl, dibutylethylbenzyl, dibutylpropylbenzyl, dibutylpentylbenzyl, dibutylhexylbenzyl, methylethylbenzyl, methylpropylbenzyl, methylbutylbenzyl, methylpentylbenzyl, methylhexylbenzyl, ethylpropylbenzyl, ethylbutylbenzyl, ethylpentylbenzyl, ethylhexylbenzyl, propylbutylbenzyl, propylpentylbenzyl, propylhexylbenzyl, butylpentylbenzyl, butylhexylbenzyl, methoxybenzyl, ethoxybenzyl, propoxybenzyl, butoxybenzyl, pentoxybenzyl, hexoxybenzyl, dimethoxybenzyl, phenoxybenzyl, methylmethoxybenzyl, dimethylaminobenzyl, dipropylaminobenzyl, bis(dimethylamino)benzyl, methyl(dimethylamino)benzyl, trifluoromethylbenzyl, bis(trifluoromethylbenzyl), trifluoromethyoxybenzyl, trimethylsilylbenzyl, bis(trimethylsilyl)benzyl, trimethylgermylbenzyl, diphenylmethyl and the like; trihydrocarbyl–silyl, –germyls, –stannyls and –plumbyls including trimethylsilyl, trimethylgermyl, trimethylstannyl, trimethylplumbyl, triethylsilyl, triethylgermyl, dimethylethylsilyl, dimethylethylgermyl, diethylmethylsilyl, diethylmethylgermyl, triphenylsilyl, triphenylgermyl, triphenoxysilyl, triphenoxygermyl, trimethoxysilyl, trimethoxygermyl, tirethoxysilyl, triethoxygermyl, and all isomers of tripropylsilyl, tripropylgermyl, tributylsilyl, tributylgermyl, tripropoxysilyl, tripropoxygermyl, tributoxysilyl, tributoxygermyl, tris(trifluormethyl)silyl, bis(perfluoromethyl)methylsilyl, and the like; all isomers and hydrocarbyl substituted isomers of polycyclic areneyls including pyrenyl, aceanthrylenyl, acenaphthylene, acephenanthrylenyl, azulenyl biphenylenyl, chrysenyl, coronenyl, fluoranthenyl, fluorenyl, heptacenyl, heptalenyl, heptaphenyl, hexacenyl, hexaphenyl, *as*-indacenyl, *s*-indecenyl, indenyl, ovalenyl, pentacenyl, pentalenyl, pentaphenyl, perylenyl, phenalenyl, phenanthrenyl, picenyl, pleiadenyl, pyranhrenyl, rubicenyl, naphthacenyl, tetraphenylenyl, trinaphthylenyl, triphenylenyl, hexahelicenyl, naphthyl, anthracenyl, dibenza[*a,b*]anthracenyl, indanyl, acenaphthenyl, cholanthrenyl, aceanthrenyl, acephenanthrenyl, 1,2,3,4-

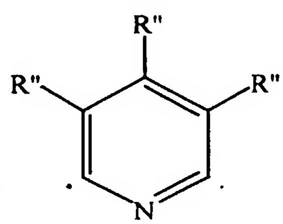
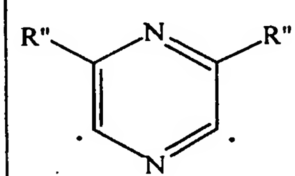
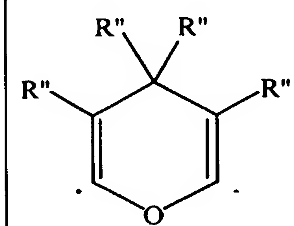
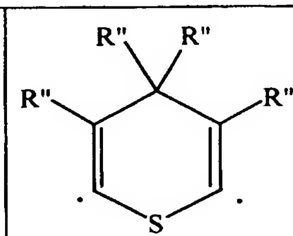
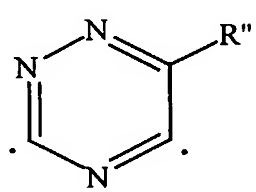
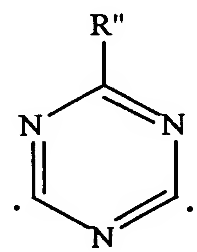
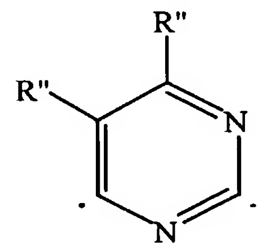
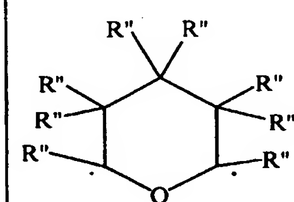
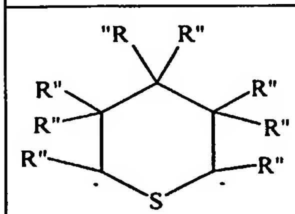
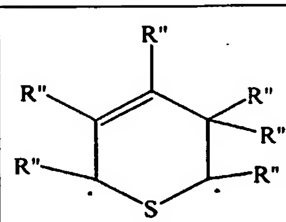
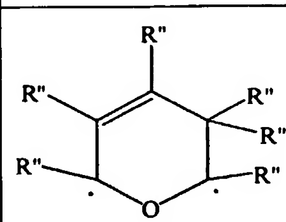
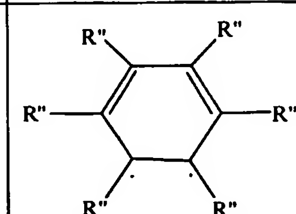
tetrahydronapthalene, fullerenyl, and the like; all isomers and hydrocarbyl substituted isomers of alicyclic monocyclic and polycyclic hydrocarbon rings including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, and cyclododecyl, dimethylcyclohexyl, norbornyl, norbornenyl, adamantyl, cubanyl, prismanyl, spiro[4,5]decanyl, and the like; all isomers and hydrocarbyl substituted isomers of ring assemblies including biphenyl, bicyclopentyl, terphenyl, quatercyclohexanyl, binaphthyl, binorbornyl, phenyl-terphenyl, and the like; all isomers and hydrocarbyl substituted isomers of bridged monocyclic and polycyclic arenyls including 1,1-diphenylmethano, 1,1-dinapthyletheno, and the like; all isomers of heterocycles and hydrocarbyl substituted heterocycles including acridarsinyl, acridinyl, acridophosphinyl, 1*H*-acrindolinyl, anthrazinyl, anthyridinyl, arsanthridinyl, arsindolyl, arsindolizinyl, arsinolinyl, arsinolizinyl, benzofuranyl, carbazolyl, β-carbolinyl, chromenyl, thiochromenyl, cinnolinyl, furanyl, imidazolyl, indazolyl, indolyl, indolizinyl, isoarsindolyl, isoarsinolinyl, isobenzofuranyl, isochromenyl, isothiochromenyl, isoindolyl, isophosphindolyl, isophosphinolinyl, isoquinolinyl, isothiazolyl, isoxazolyl, naphthyridinyl, oxazolyl, perimidinyl, phenanthrazinyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phosphanthridinyl, phosphindolyl, phosphindolizinyl, phosphinolizinyl, phthalazinyl, pteridinyl, phthaloperinyl, purinyl, pyranyl, thiopyranal, pyrazinyl, pyrazolyl, pyridazinyl, pyridinyl, pyrindinyl, pyrimidinyl, pyrrolyl, pyrrolizinyl, quinazolinyl, quindolinyl, 1*H*-quinindolinyl, quinolinyl, quinolizinyl, quinoxalinyl, selenophenyl, thebenidinyl, thiazolyl, thiophenyl, triphenodioxazinyl, triphenodithiazinyl, xanthenyl, chromanyl, thiochromanyl, imidazolidinyl, indolinyl, isochromanyl, isothiochromanyl, isoindolinyl, morpholinyl, piperazinyl, piperidinyl, pyrozolidinyl, pyrrolidinyl, quinuclidinyl, dimethylacridarsinyl, dimethylacridinyl, dimethylacridophosphinyl, dimethyl-1*H*-acrindolinyl, dimethylanthrazinyl, dimethylanthyridinyl, dimethylarsanthridinyl, dimethylarsindolyl, dimethylarsindolizinyl, dimethylarsinolinyl, dimethylarsinolizinyl, dibutylbenzofuranyl, dibutylcarbazolyl, dibutyl-β-carbolinyl, dibutylchromenyl, dibutylthiochromenyl, butylcinnolinyl, dibutylfuranyl, dimethylimidazolyl, dimethylindazolyl, dipropylindolyl, dipropylindolizinyl, dimethylisoarsindolyl, methylisoarsinolinyl, dimethylisobenzofuranyl, diphenylisochromenyl, dibutylisothiochromenyl,

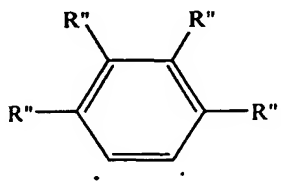
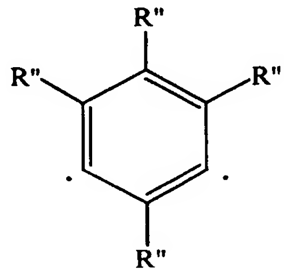
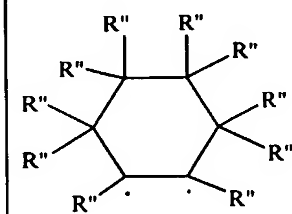
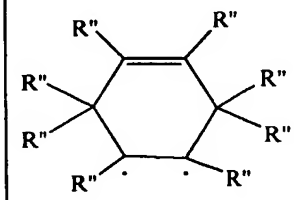
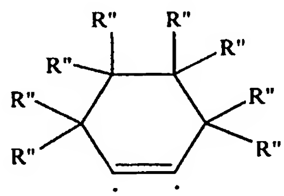
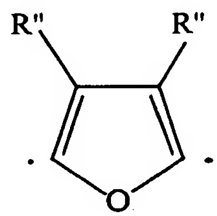
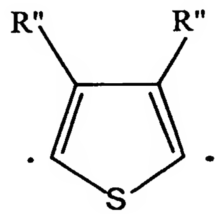
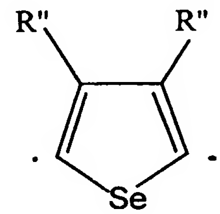
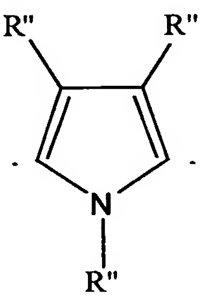
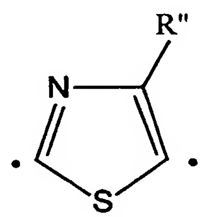
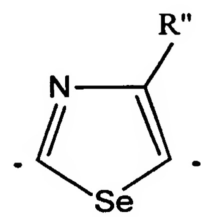
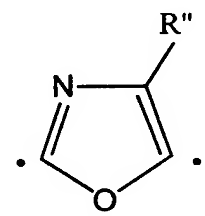
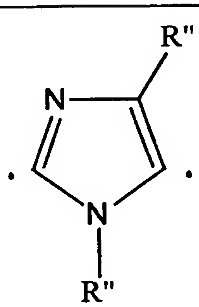
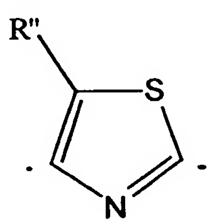
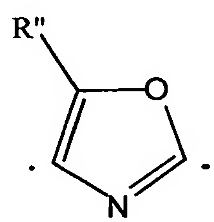
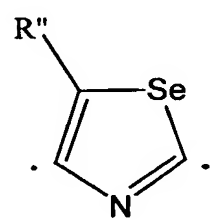
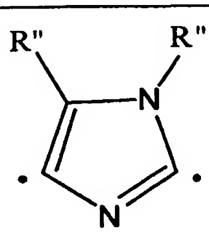
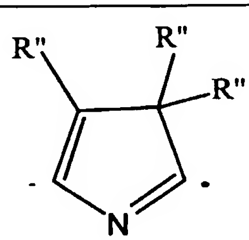
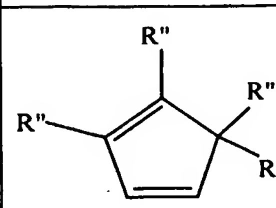
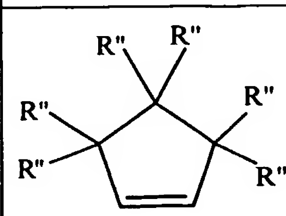
phenylisoindolyl, butylisophosphindolyl, dibutylisophosphinolinyl, dimethylisoquinolinyl, methylisothiazolyl, butylisoxazolyl, butylnaphthyridinyl, dimethyloxazolyl, methylphenylperimidinyl, tetrabutylphenanthrazinyl, propylphenanthridinyl, dibutylphenanthrolinyl, tetramethylphenazinyl, butylphosphanthridinyl, phenylphosphindolyl, dimethylphosphindolizinyl, methylphosphinolizinyl, dibutylphthalazinyl, trimethylpteridinyl, methylphthaloperinyl, dimethylpurinyl, dibutylpyranyl, dibutylthiopyranal, trimethylpyrazinyl, phenylpyrazolyl, dipropylpyridazinyl, dimethylpyridinyl, methylpropylpyrindinyl, triethylpyrimidinyl, dibutylpyrrolyl, diethylpyrrolizinyl, dibutylquinazolinyl, dibutylquindolinyl, dibutyl-1*H*-quinindolinyl, dimethylquinolinyl, propylquinolizinyl, methylquinoxalinyl, methylbutylselenophenyl, methylthebenidinyl, dimethylthiazolyl, trimethylthiophenyl, dibutyltriphenodioxazinyl, dibutyltriphenodithiazinyl, dibutylxanthenyl, trimethylchromanyl, dimethylthiochromanyl, dimethylimidazolidinyl, dimethylindolinyl, dibutylisochromanyl, dibutylisothiochromanyl, phenylisoindolinyl, dibutylmorpholinyl, dimethylpiperazinyl, dimethylpiperidinyl, dimethylpyrozolidinyl, dimethylpyrrolidinyl, bipyridyl, pyrido[2,1,6-*de*]quinolizinyl, hexamethylquinuclidinyl, 5,7-dioxa-6-phosphadibenzo[*a,c*]cycloheptene-6-oxide, 9-oxa-10-phosphaphenanthrene-10-oxide and the like.

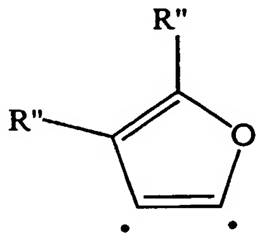
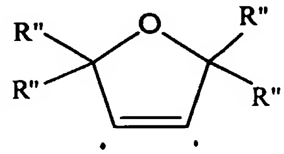
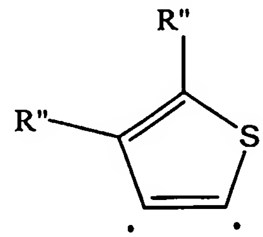
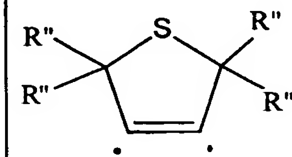
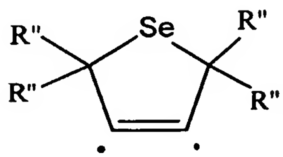
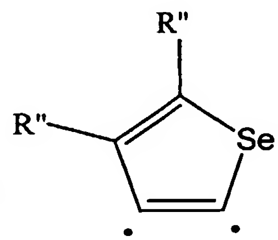
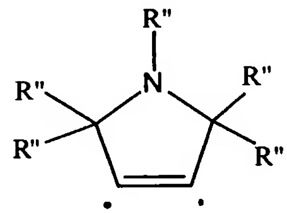
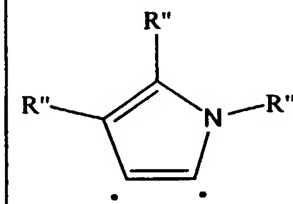
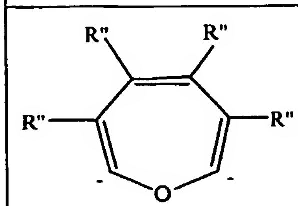
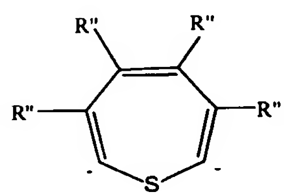
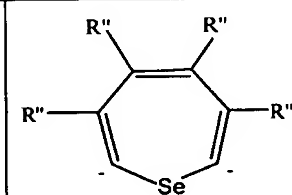
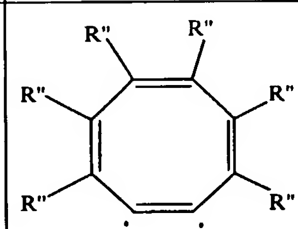
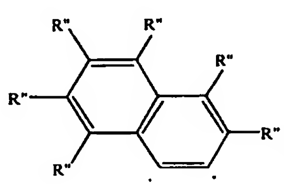
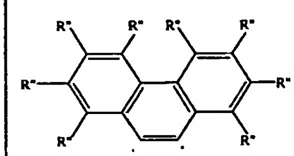
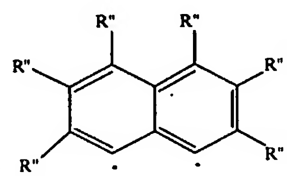
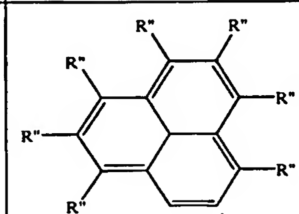
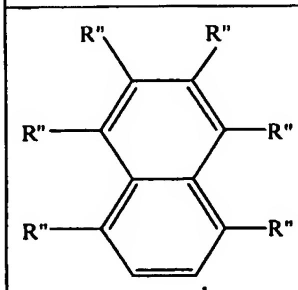
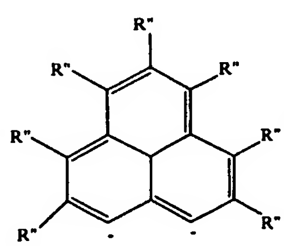
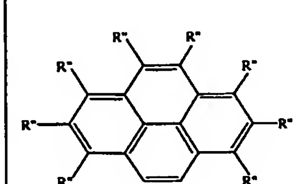
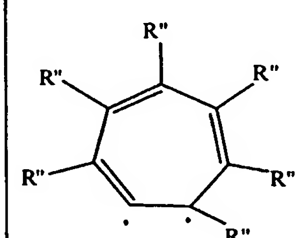
The bridging group A may be represented by the following formulae:

R'_2C, R'_2Si, R'_2Ge, $R'_2CCR'_2$, $R'_2CCR'_2CR'_2$, $R'_2CCR'_2CR'_2CR'_2$, $R'C{=}CR'$, $R'C{=}CR'CR'_2$, $R'_2CCR'{=}CR'CR'_2$, $R'C{=}CR'CR'{=}CR'$, $R'C{=}CR'CR'_2CR'_2$, $R'_2CSiR'_2$, $R'_2SiSiR'_2$, $R'_2CSiR'_2CR'_2$, $R'_2SiCR'_2SiR'_2$, $R'C{=}CR'SiR'_2$, $R'_2CGeR'_2$, $R'_2GeGeR'_2$, $R'_2CGeR'_2CR'_2$, $R'_2GeCR'_2GeR'_2$, $R'_2SiGeR'_2$, $R'C{=}CR'GeR'_2$, $R'B$, $R'_2C{-}BR'$, $R'_2C{-}BR'{-}CR'_2$, $R'N$, $R'P$, O, S, Se, $C({=}O)C({=}O)$, $R'_2CC({=}O)$, $R'_2CC({=}O)CR'_2$, $R'_2C{-}O{-}CR'_2$, $R'_2CR'_2C{-}O{-}CR'_2CR'_2$, $R'_2C{-}O{-}CR'_2CR'_2$, $R'_2C{-}O{-}CR'{=}CR'$, $R'_2C{-}S{-}CR'_2$, $R'_2CR'_2C{-}S{-}CR'_2CR'_2$, $R'_2C{-}S{-}CR'_2CR'_2$, $R'_2C{-}S{-}CR'{=}CR'$, $R'_2C{-}Se{-}CR'_2$, $R'_2CR'_2C{-}Se{-}CR'_2CR'_2$, $R'_2C{-}Se{-}CR'_2CR'_2$, $R'_2C{-}Se{-}CR'{=}CR'$, $R'_2C{-}N{=}CR'$, $R'_2C{-}NR'{-}CR'_2$, $R'_2C{-}NR'{-}CR'_2CR'_2$, $R'_2C{-}NR'{-}CR'{=}CR'$, $R'_2CR'_2C{-}NR'{-}CR'_2CR'_2$, $R'_2C{-}P{=}CR'$, and $R'_2C{-}PR'{-}CR'_2$ where the

bonding of A is illustrated in formulae L1-L23, R' is, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, and two or more R' on the same carbon or adjacent R' may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent. Non-limiting examples of cyclic bridging groups useful as A are illustrated below. The connection (bonding) points of the cyclic structures are designated by the "dots".

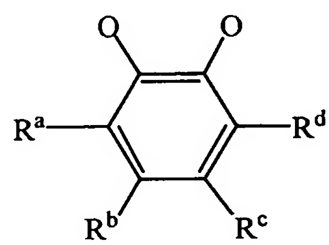
 A1	 A2	 A3	 A4
 A5	 A6	 A7	 A8
 A9	 A10	 A11	 A12

 A13	 A14	 A15	 A16
 A17	 A18	 A19	 A20
 A21	 A22	 A23	 A24
 A25	 A26	 A27	 A28
 A29	 A30	 A31	 A32

			
A33	A34	A35	A36
			
A37	A38	A39	A40
			
A41	A42	A43	A44
			
A45	A46	A47	A48
			
A49	A50	A51	A52

where R" is, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, and two or more R'' on the same carbon or adjacent R'' may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

The substituted or unsubstituted catecholate ligand, X, may be represented by the following formula:

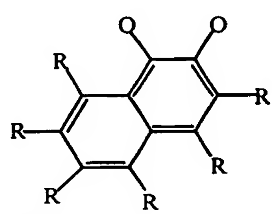


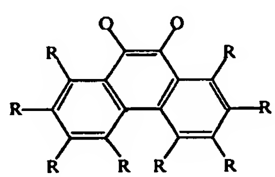
where each O is bonded to M, and where R^a, R^b, R^c and R^d are, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl, and optionally two or more adjacent R^a, R^b, R^c and/or R^d may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

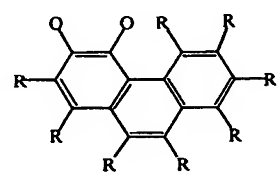
Some invention embodiments, independently, select R^a, R^b, R^c and R^d from hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl,

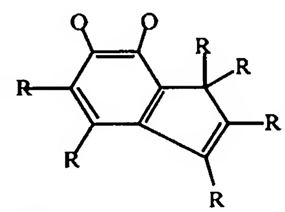
benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy, phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group. It is preferred that at least one R^a, R^b, R^c or R^d is not hydrogen.

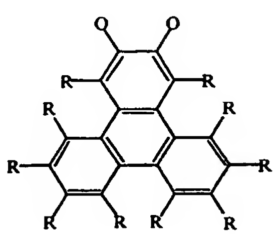
Below are non-limiting examples in which the catecholate has been transformed into a fused ring system:

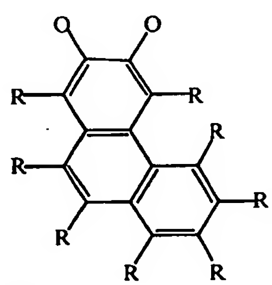

X1

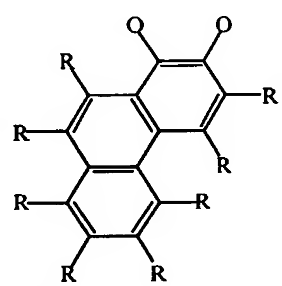

X2

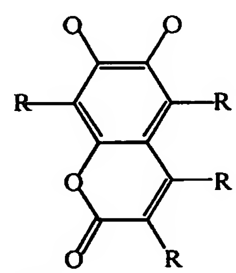

X3

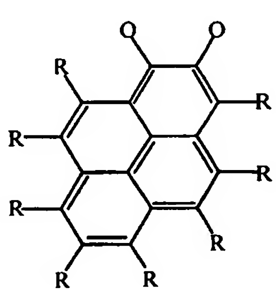

X4

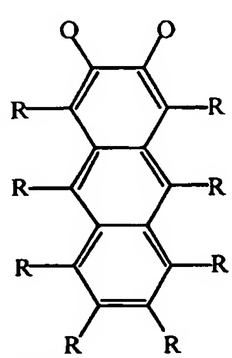

X5

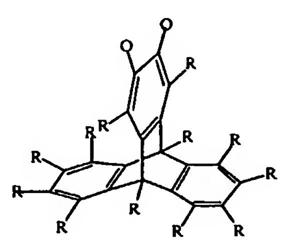

X6

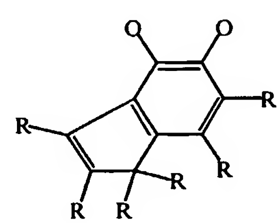

X7

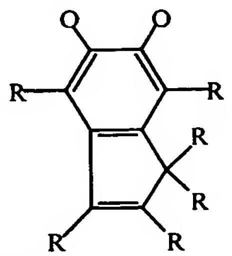
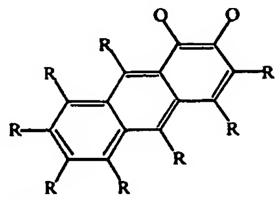
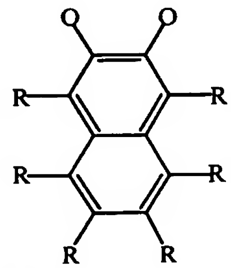
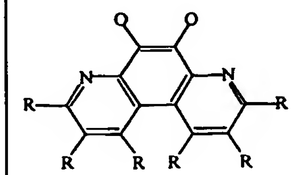
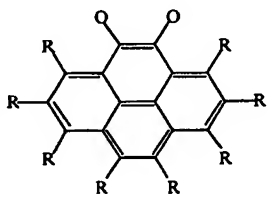
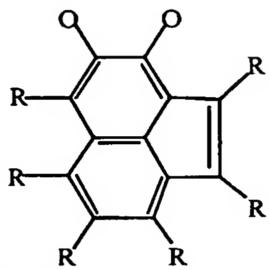
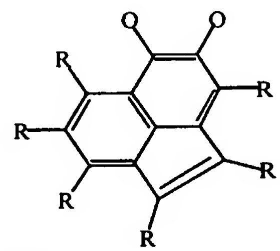
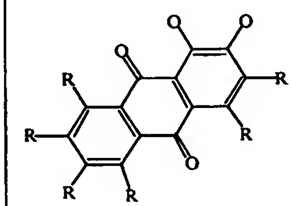
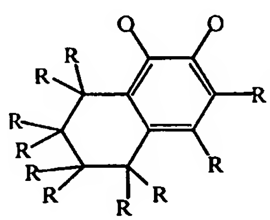
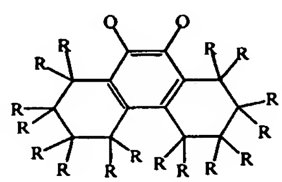
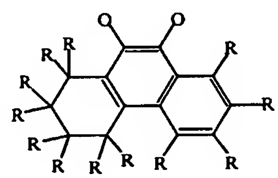
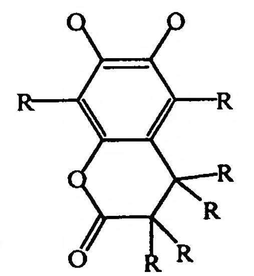
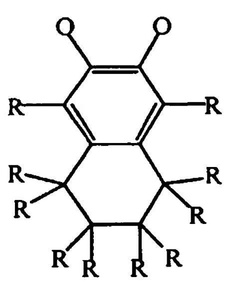
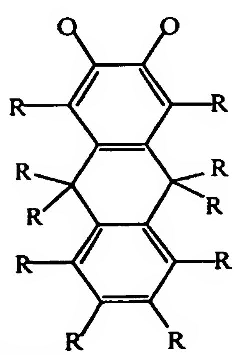
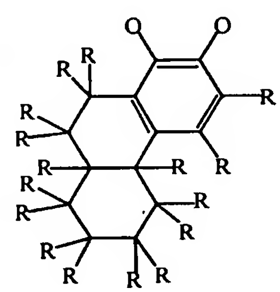
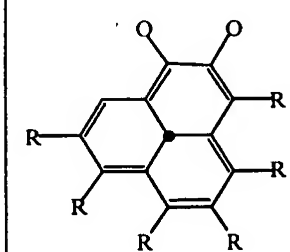

X8

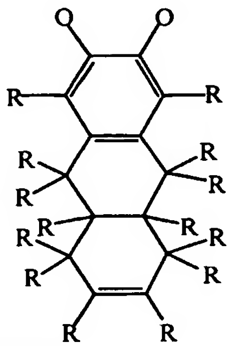
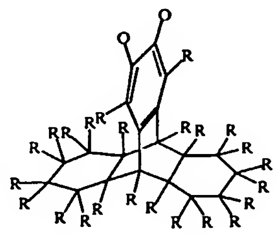
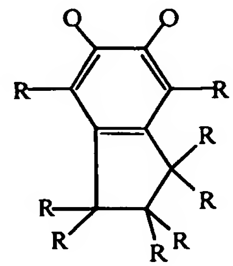
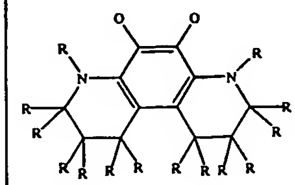
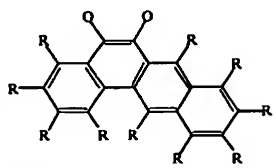
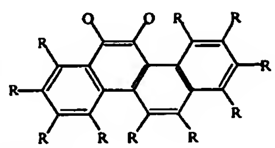
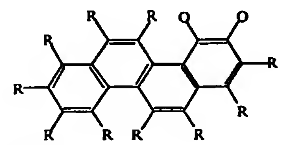
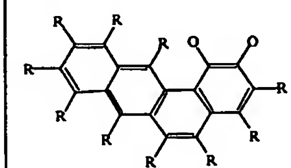
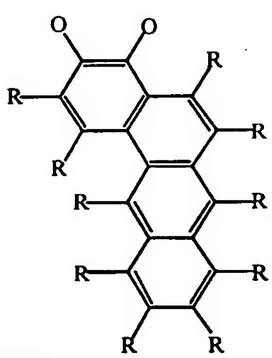
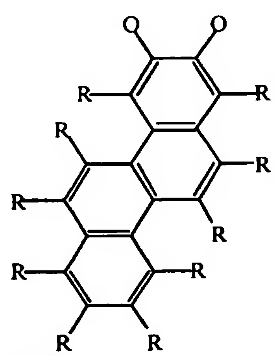
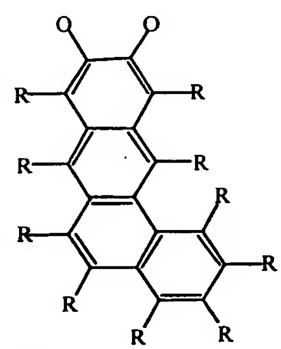
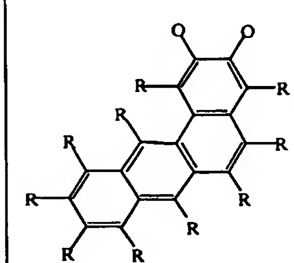
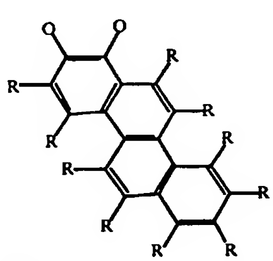
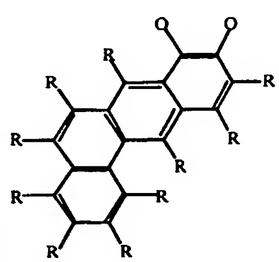
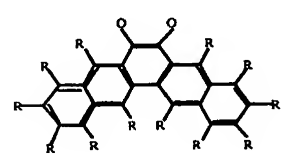
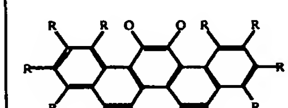

X9

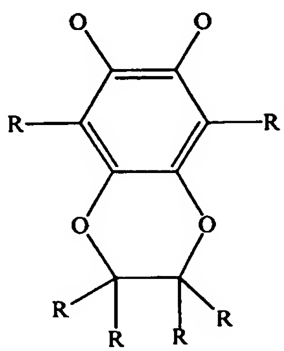
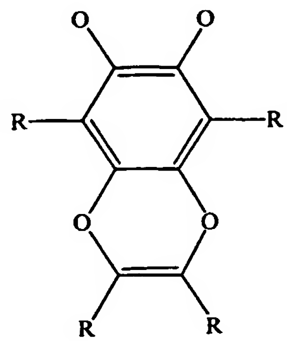
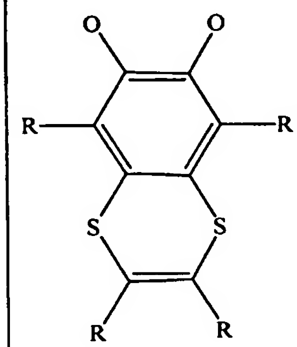
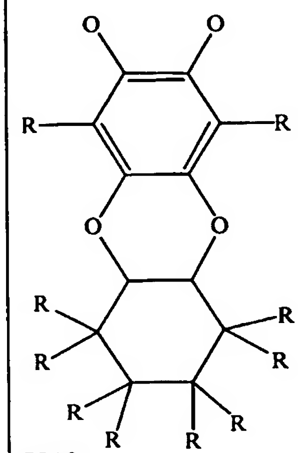
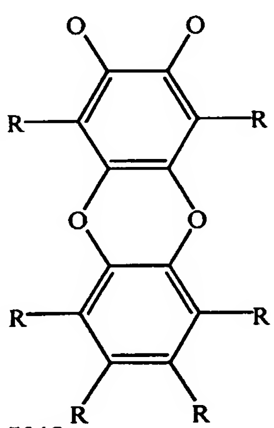
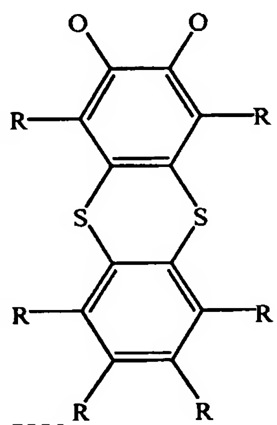
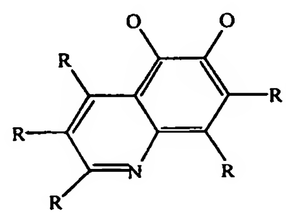
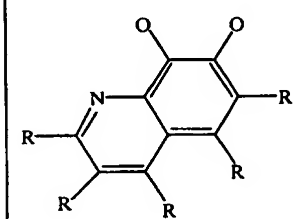

X10


X11


X12

 X13	 X14	 X15	 X16
 X17	 X18	 X19	 X20
 X21	 X22	 X23	 X24
 X25	 X26	 X27	 X28

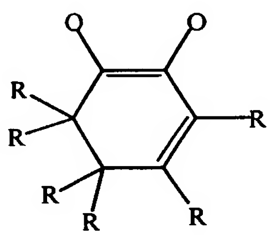
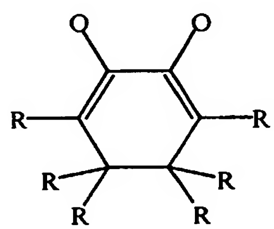
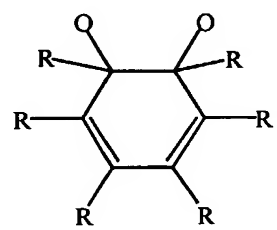
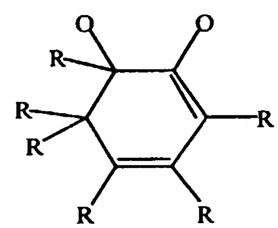
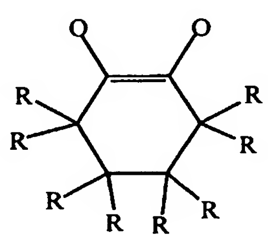
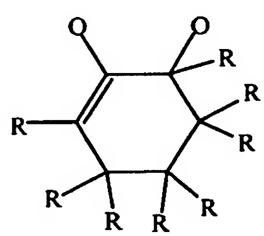
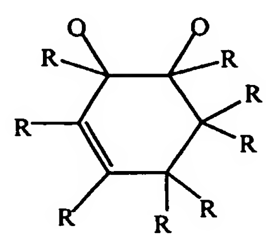
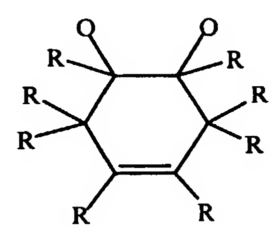
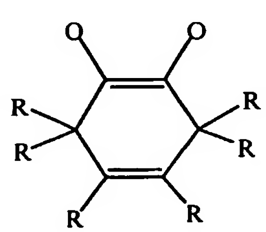
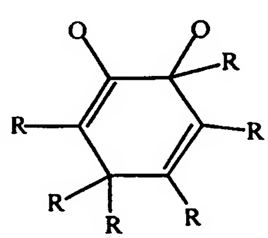
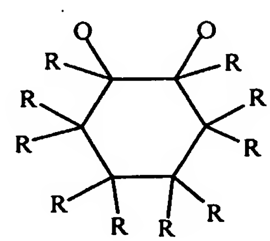
 X29	 X30	 X31	 X32
 X33	 X34	 X35	 X36
 X37	 X38	 X39	 X40
 X41	 X42	 X43	 X44

 X45	 X46	 X47	 X48
 X49	 X50	 X51	 X52

where R is, independently, hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl,

cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy, phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group. Two R groups can connect to form substituted or unsubstituted, saturated, partially unsaturated or aromatic ring structures.

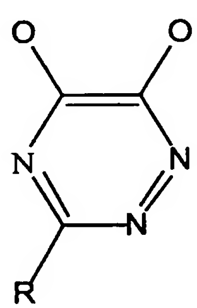
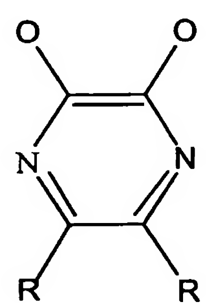
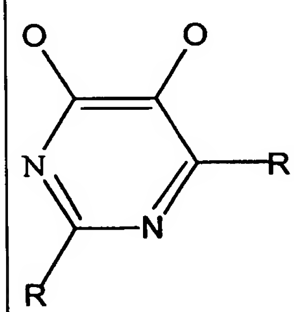
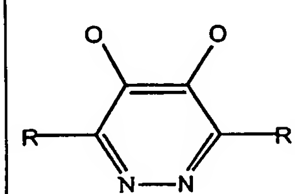
Below are non-limiting examples in which the catecholate has been fully or partially hydrogenated:

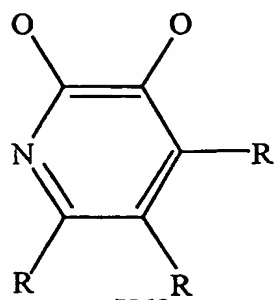
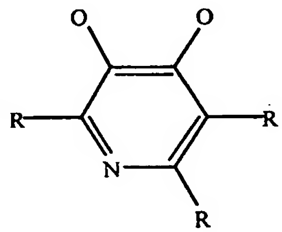
 X53	 X54	 X55	 X56
 X57	 X58	 X59	 X60
 X61	 X62	 X63	

where R is, independently, hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl,

nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy, phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group. Two R groups can connect to form substituted or unsubstituted, saturated, partially unsaturated or aromatic ring structures. It is preferred that at least one R group is not hydrogen.

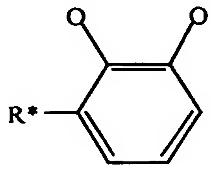
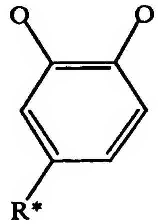
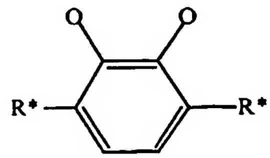
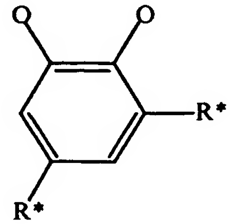
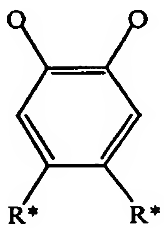
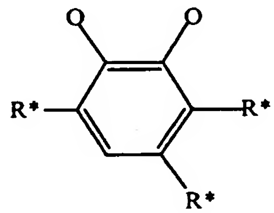
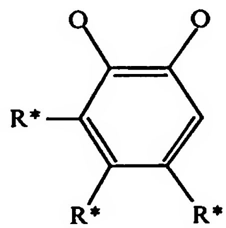
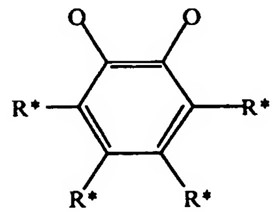
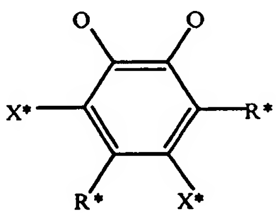
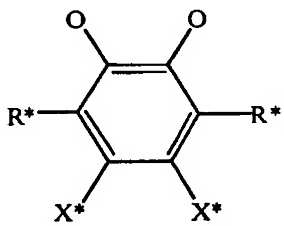
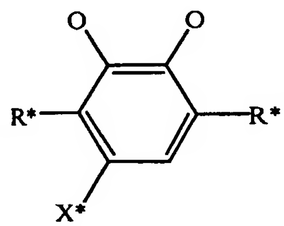
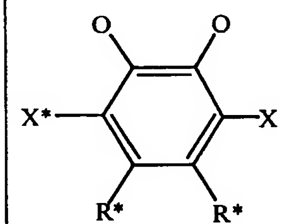
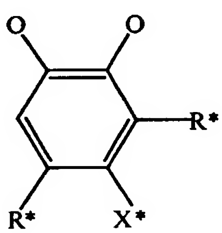
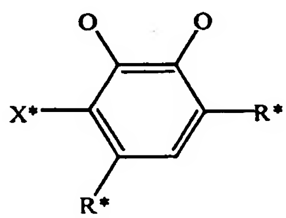
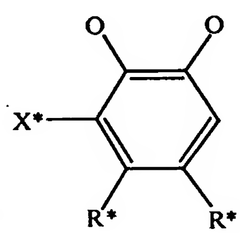
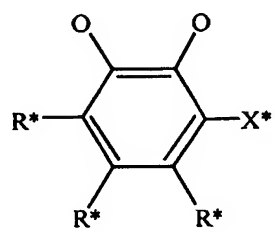
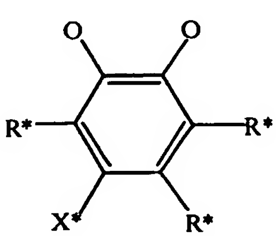
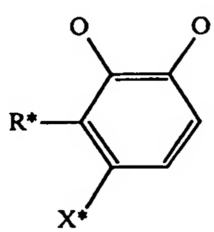
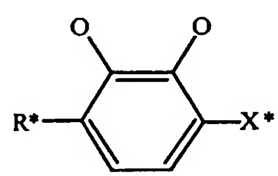
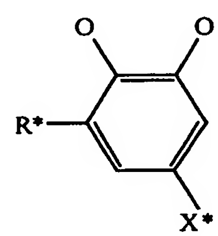
Below are non-limiting examples of catecholate-like ligands that may be used in place of the catecholate ligand:

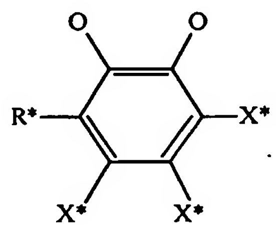
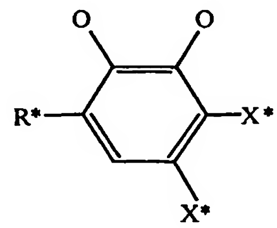
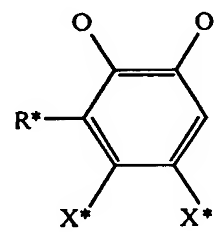
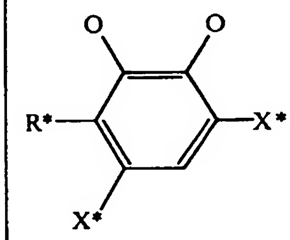
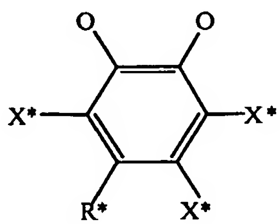
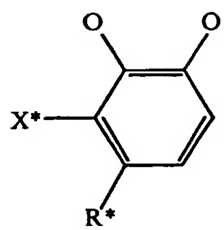
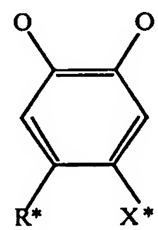
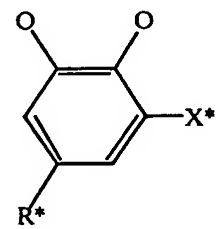
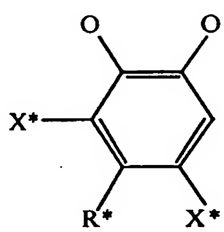
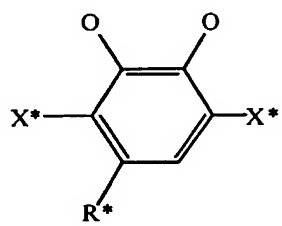
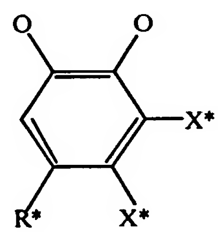
 X64	 X65	 X66	 X67

 X68	 X69		

where R is, independently, hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy, phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group. Two R groups can connect to form substituted or unsubstituted, saturated, partially unsaturated or aromatic ring structures. It is preferred that at least one R group is not hydrogen.

Some embodiments select at least one or two R^a, R^b, R^c or R^d to be a hydrocarbyl substituent such as butyl. Below are non-limiting examples in which the catecholate may contain substituents:

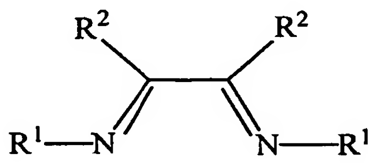
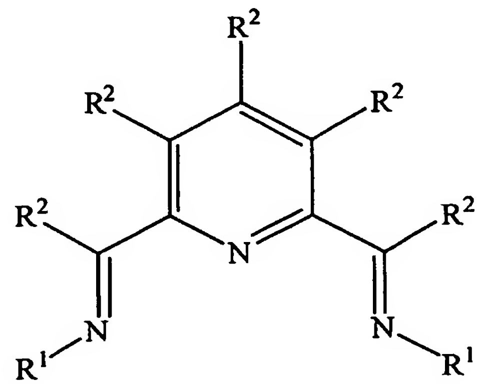
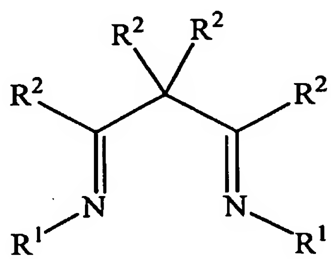
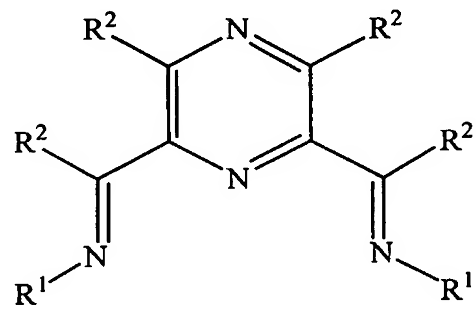
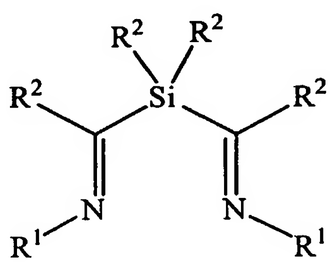
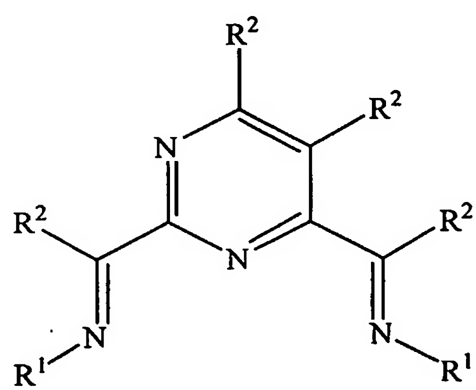
 X70	 X71	 X72	 X73
 X74	 X75	 X76	 X77
 X78	 X79	 X80	 X81
 X82	 X83	 X84	 X85
 X86	 X87	 X88	 X89

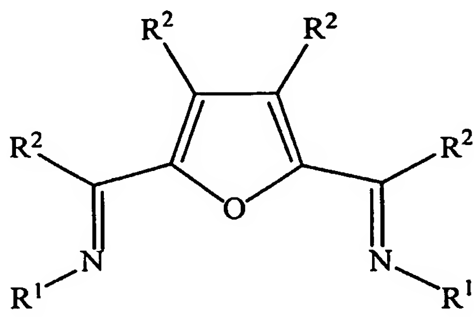
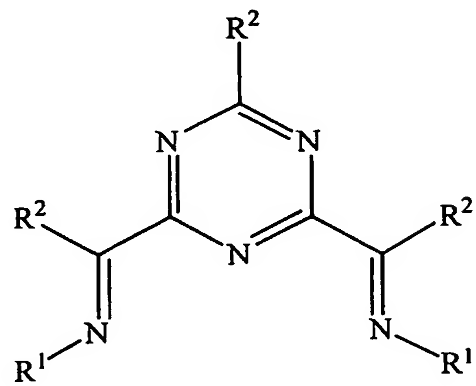
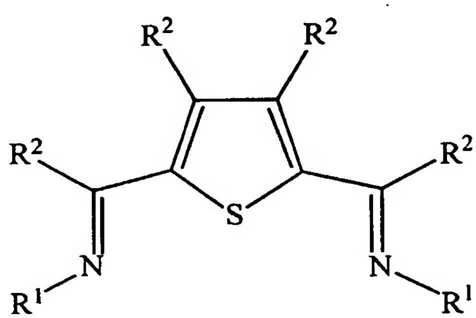
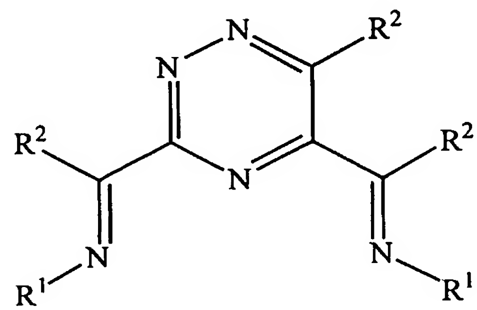
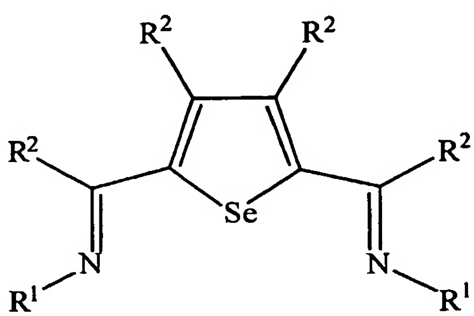
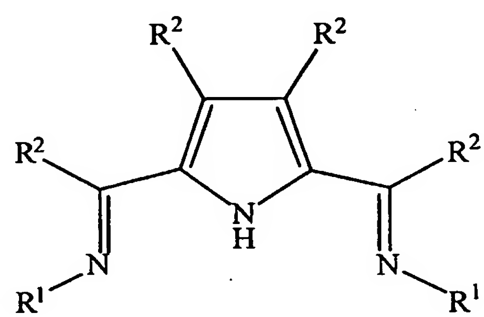
 X90	 X91	 X92	 X93
 X94	 X95	 X96	 X97
 X98	 X99	 X100	

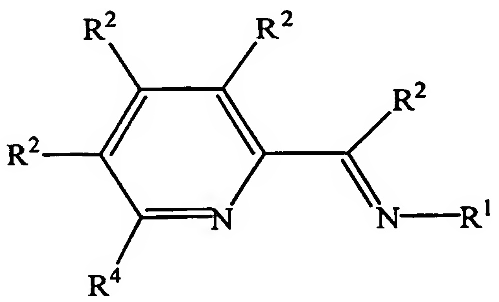
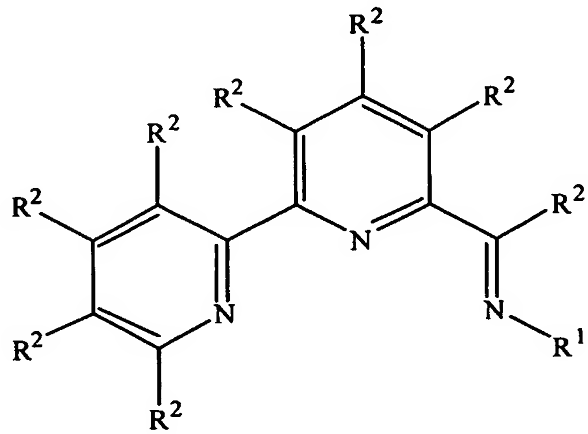
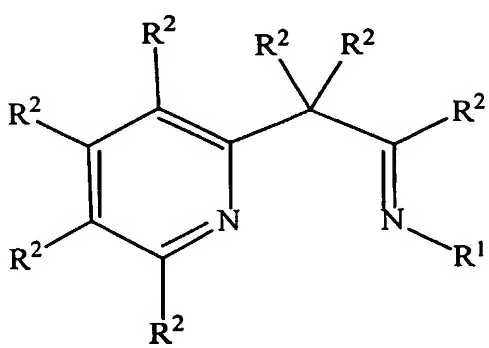
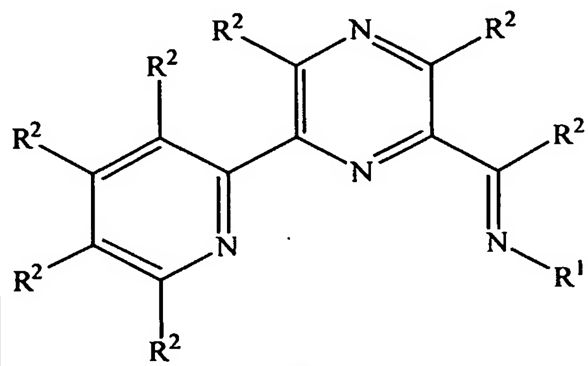
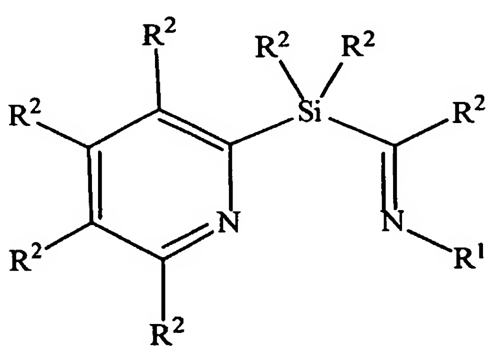
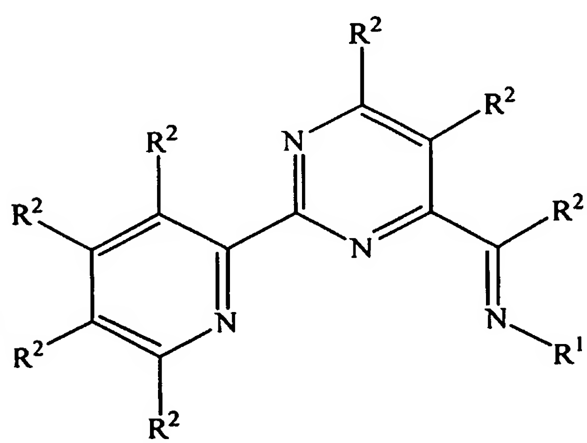
where X* is, independently, F, Cl, Br, I, OR**, SR**, NR**$_2$, PR**$_2$, NO_2; each R* and each R** are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *tert*-butyl, or cyclohexyl. R* is most preferably *tert*-butyl or *iso*-propyl, R** is most preferably methyl, and X* is most preferably F, Cl, Br or OR**.

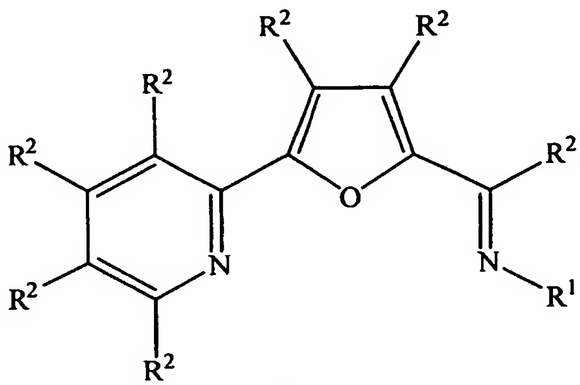
Preferred transition metals, M, include those from Group 8 (Fe, Ru, Os), Group 9 (Co, Rh, Ir), Group 10 (Ni, Pd, Pt), and Group 11 (Cu, Ag, Au). Most preferred transition metals include Fe, Co, Ni, and Pd.

Preferred bulky bidentate or tridentate neutrally charged ligands, L, include:

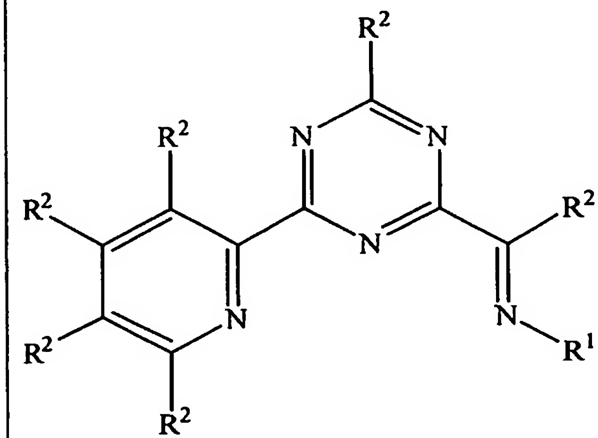
 L*1	 L*2
 L*3	 L*4
 L*5	 L*6

 L*7	 L*8
 L*9	 L*10
 L*11	 L*12

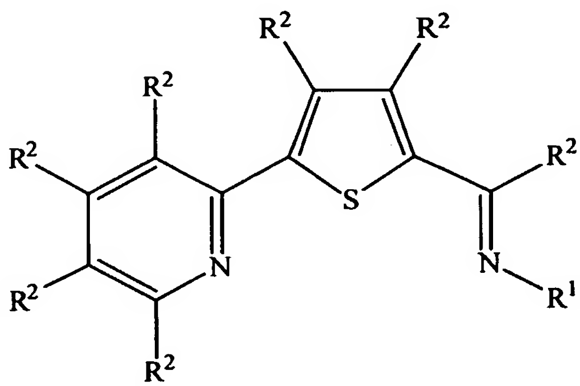
 L*13	 L*14
 L*15	 L*16
 L*17	 L*18



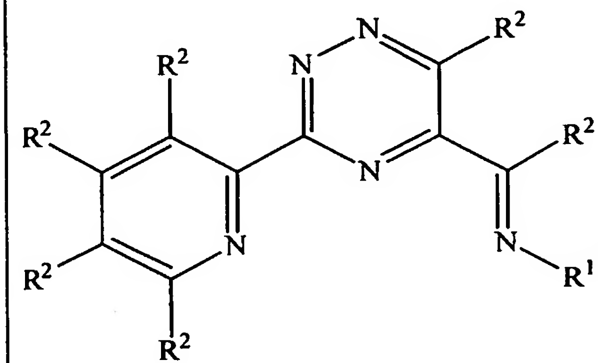
L*19



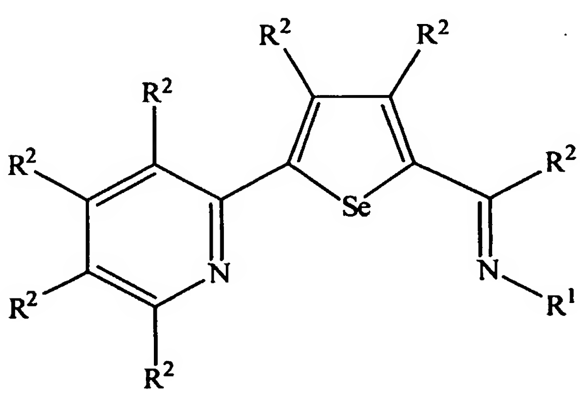
L*20



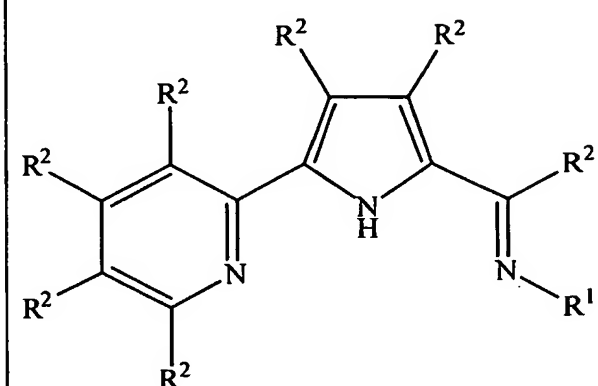
L*21



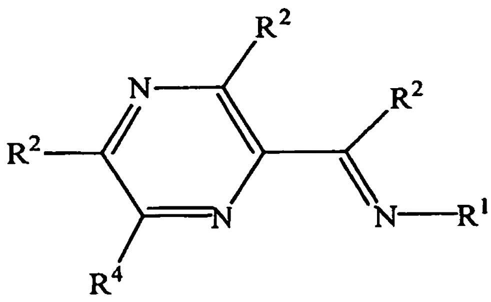
L*22



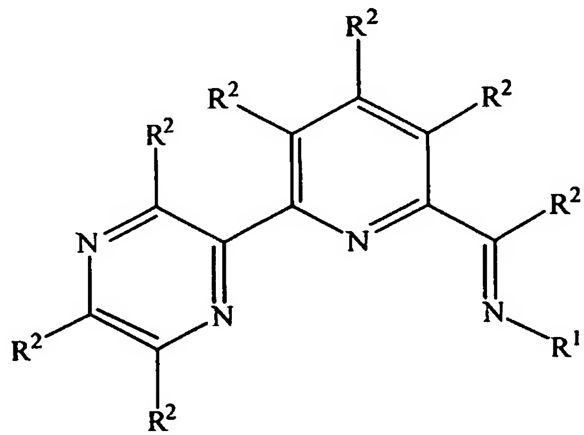
L*23



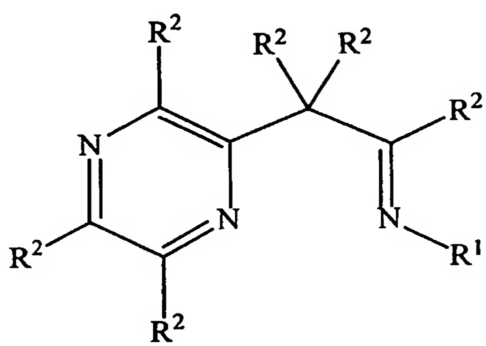
L*24



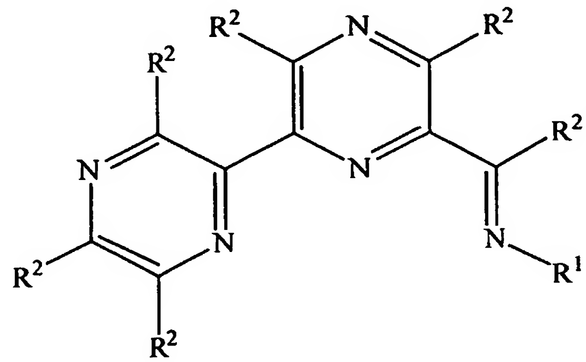
L*25



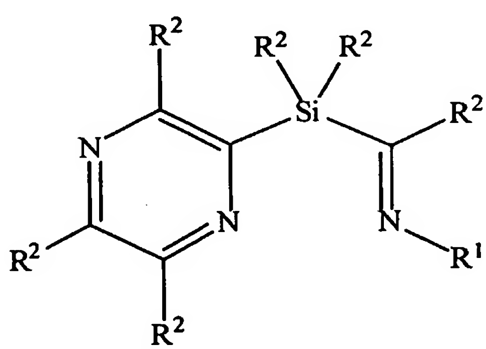
L*26



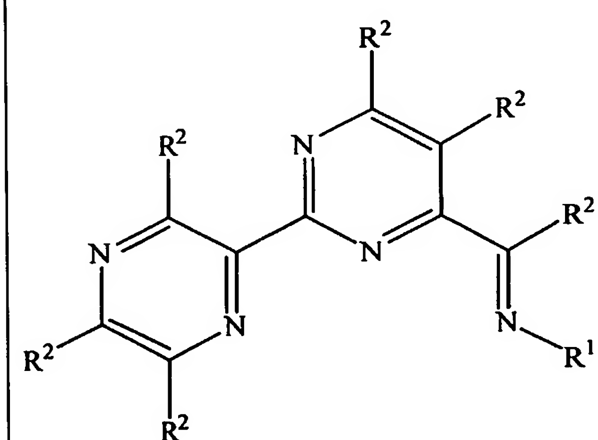
L*27



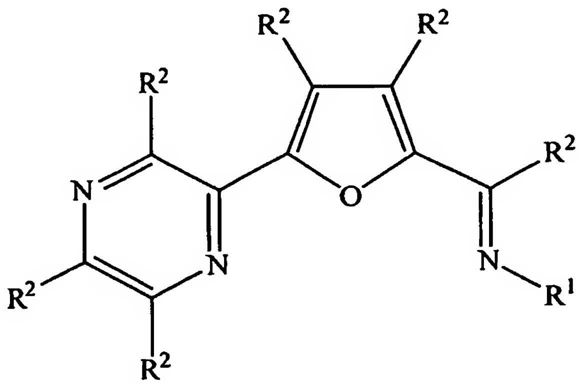
L*28



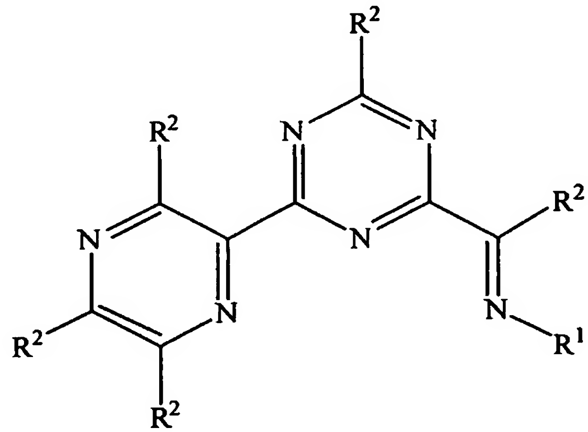
L*29



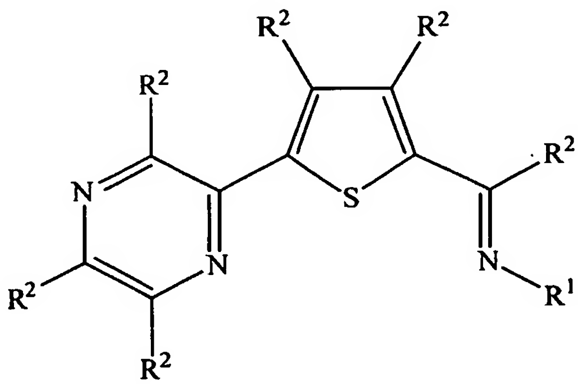
L*30



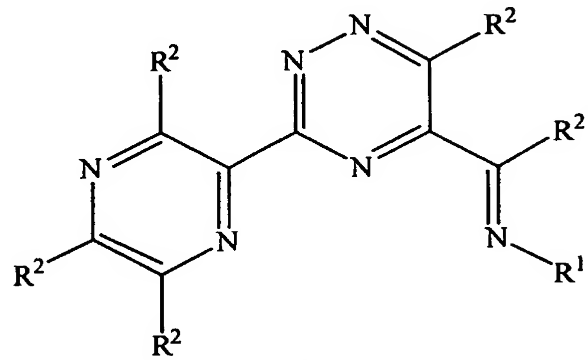
L*31



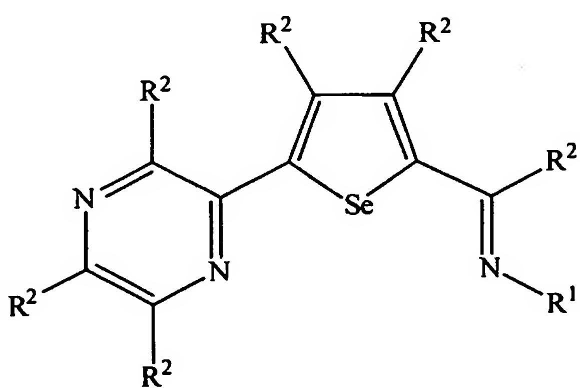
L*32



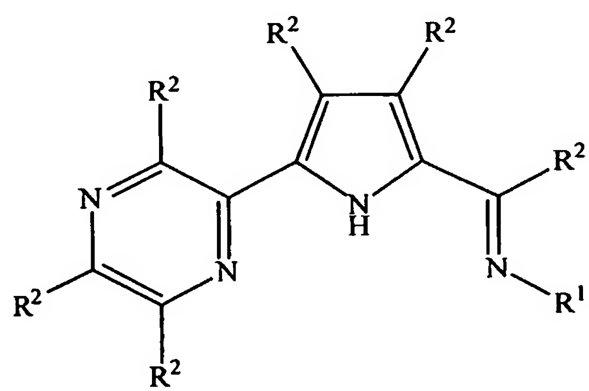
L*33



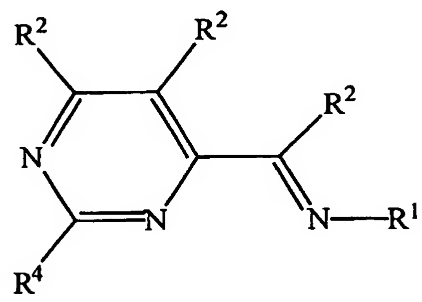
L*34



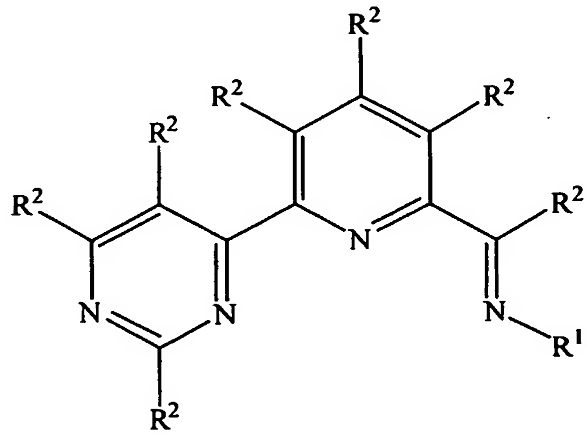
L*35



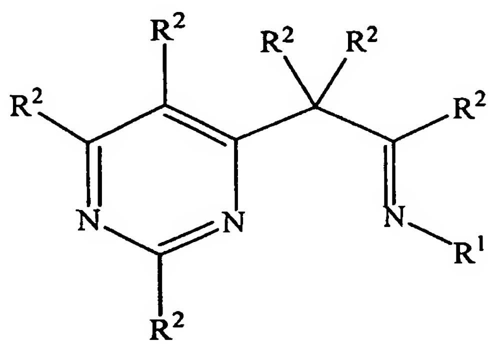
L*36



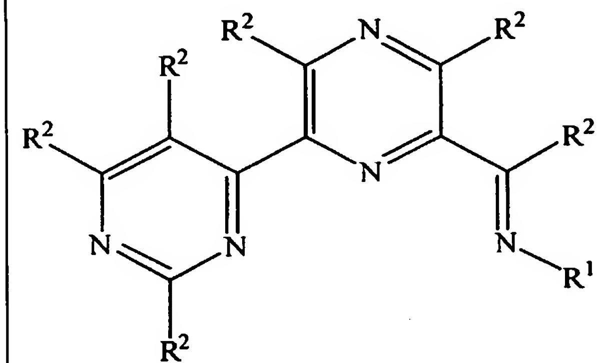
L*37



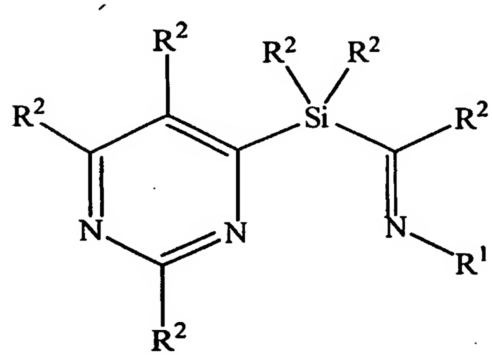
L*38



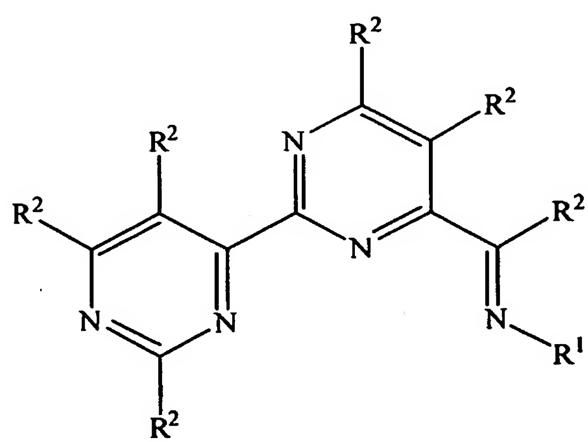
L*39



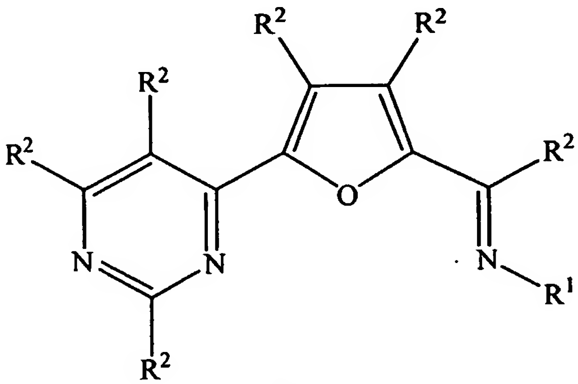
L*40

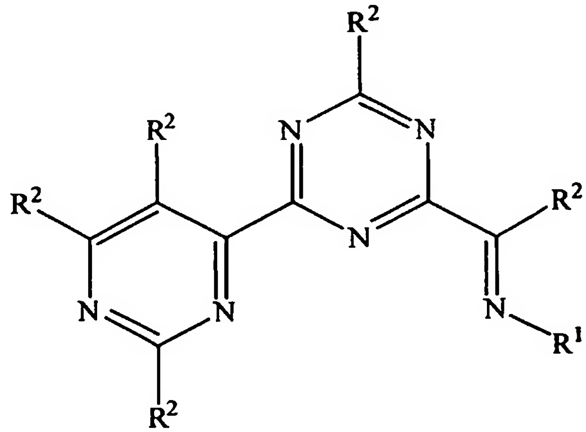


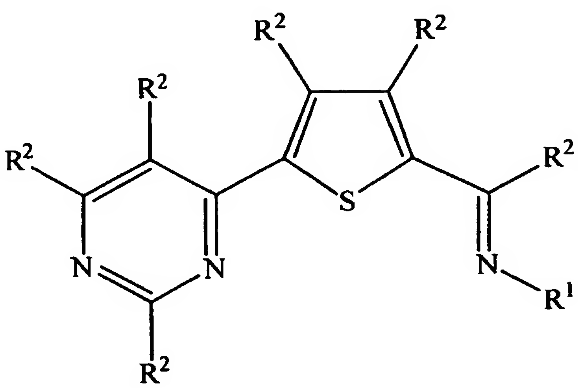
L*41

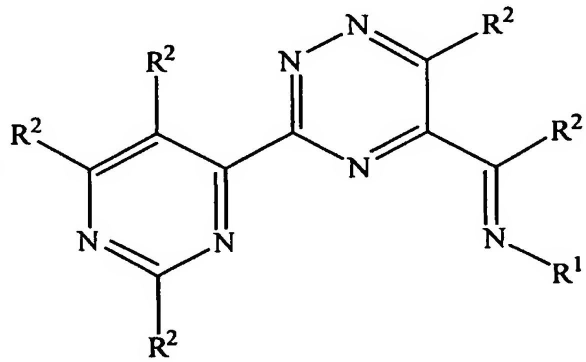


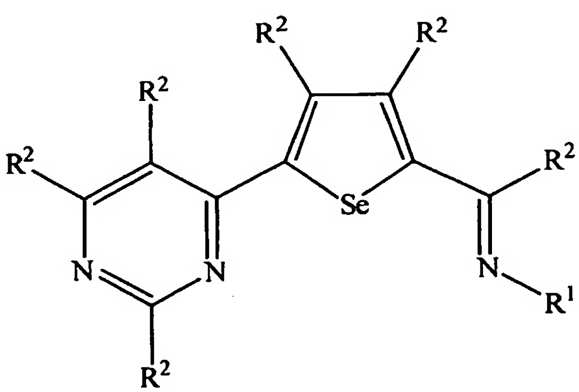
L*42

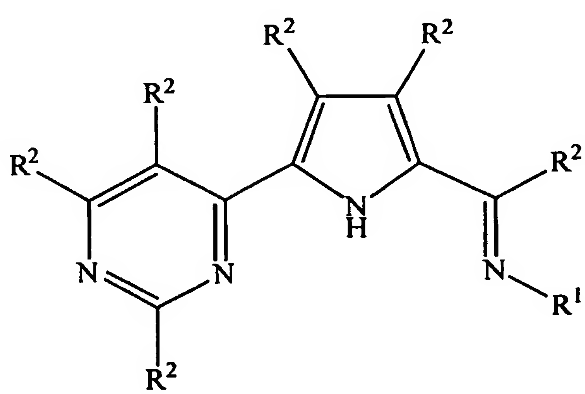

L*43

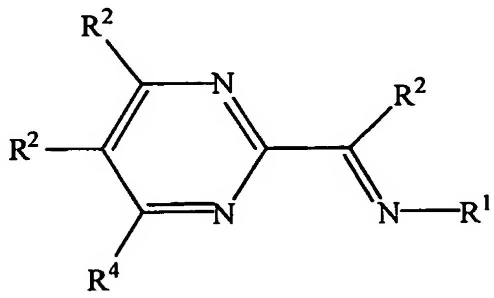
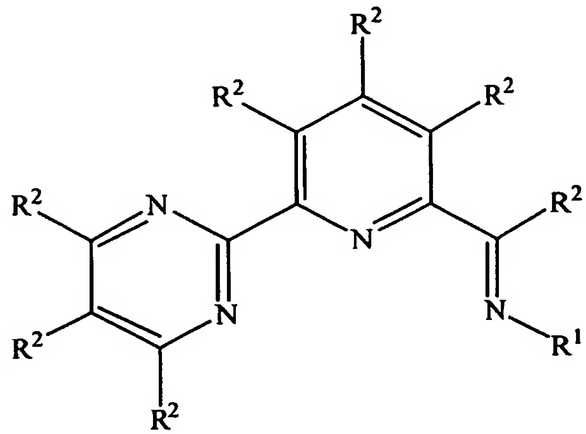
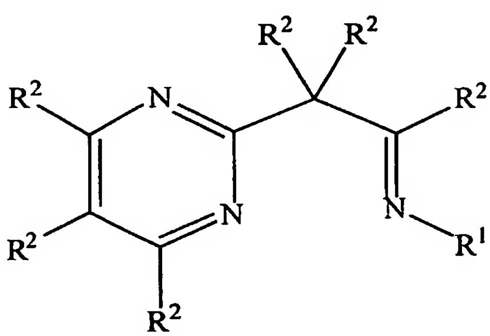
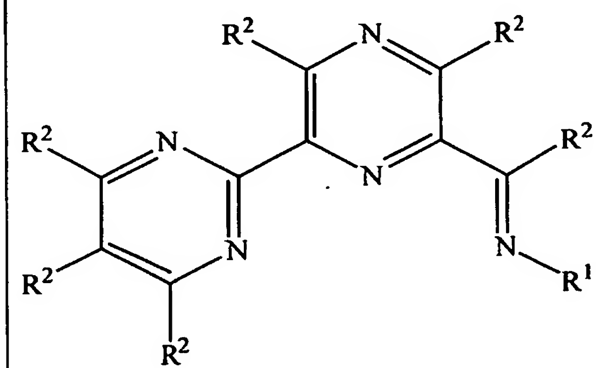
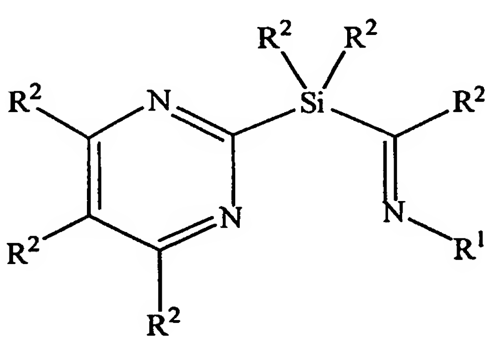
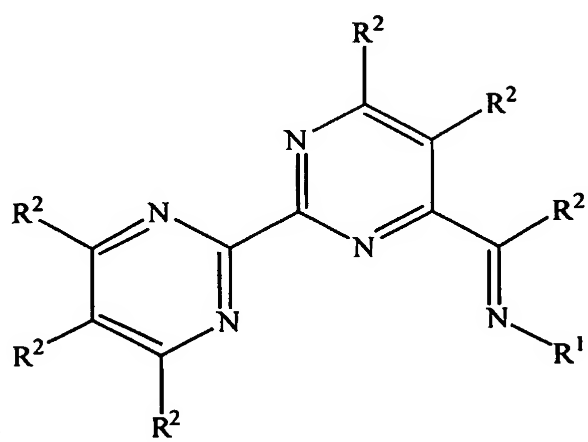

L*44

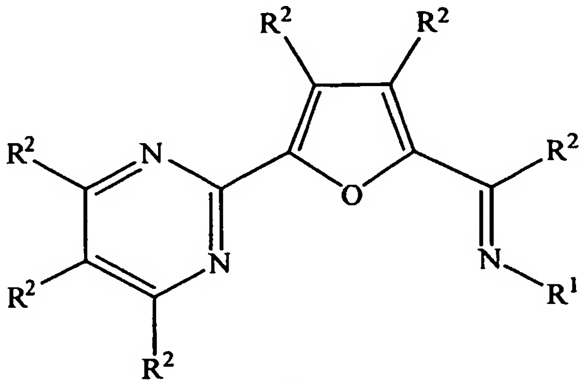

L*45


L*46

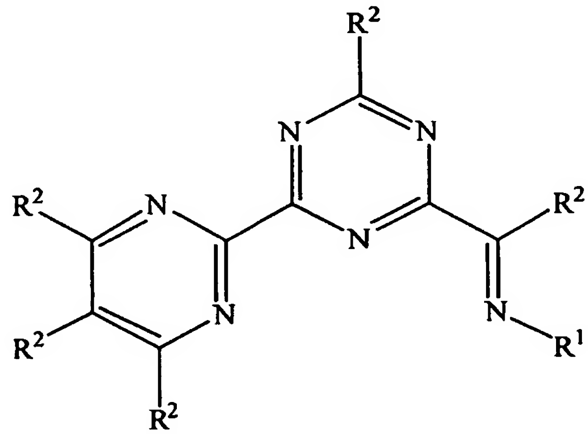

L*47


L*48

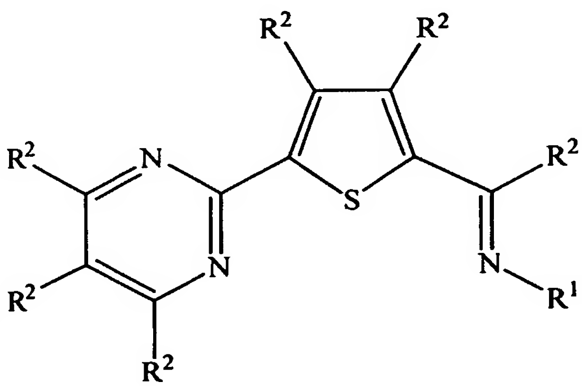
 L*49	 L*50
 L*51	 L*52
 L*53	 L*54



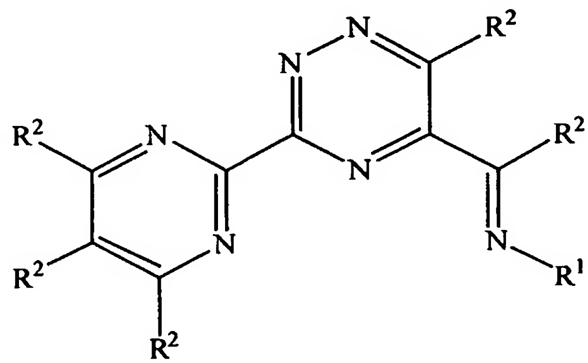
L*55



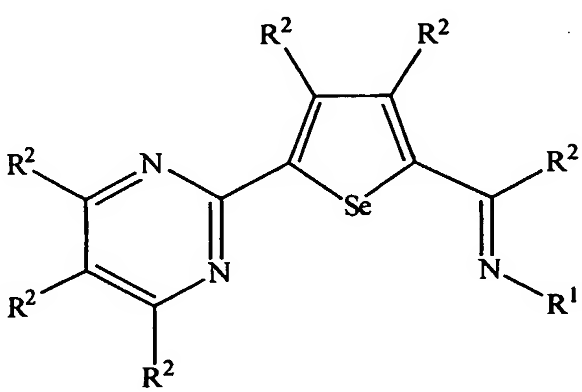
L*56



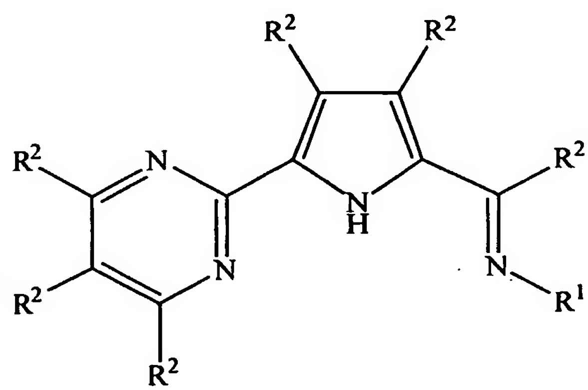
L*57



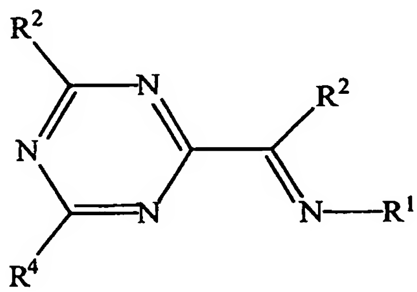
L*58



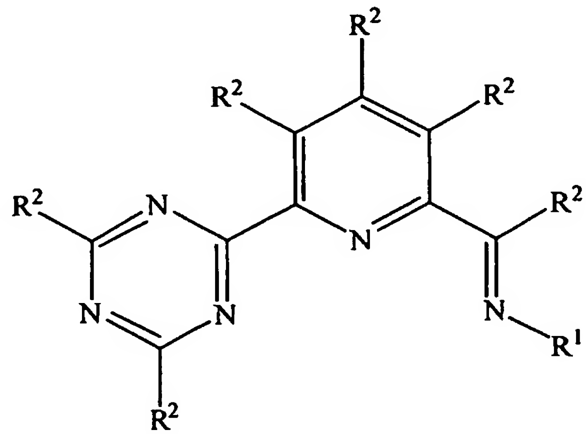
L*59



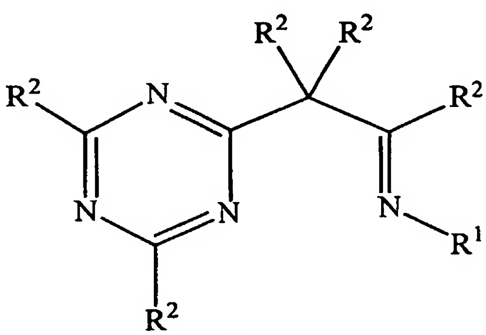
L*60



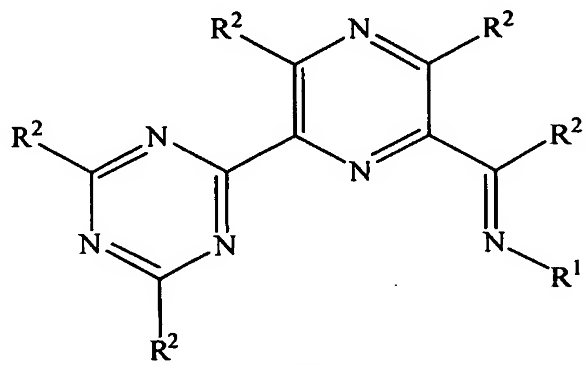
L*61



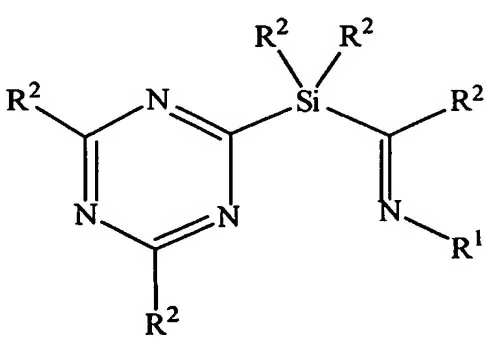
L*62



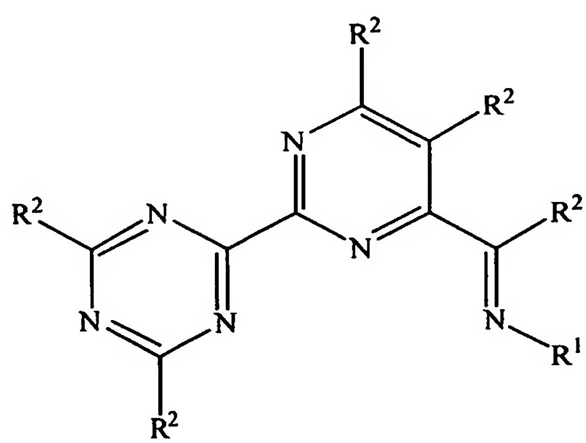
L*63



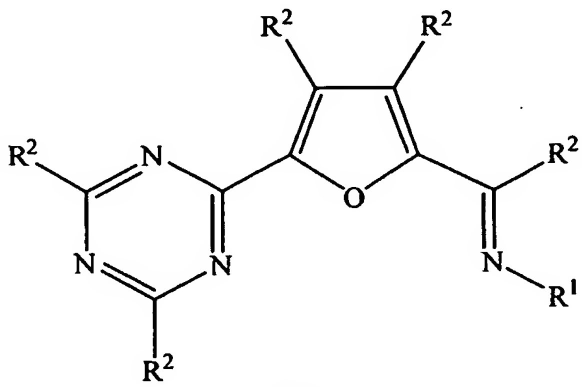
L*64



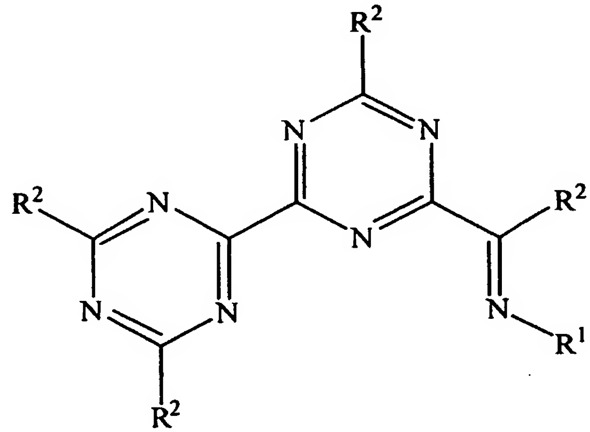
L*65



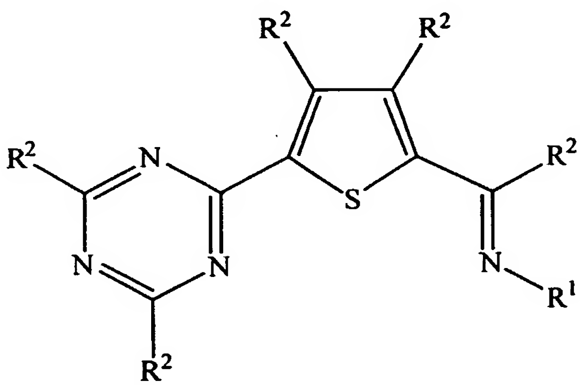
L*66



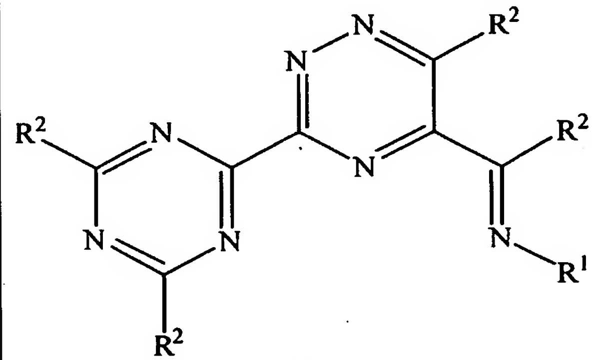
L*67



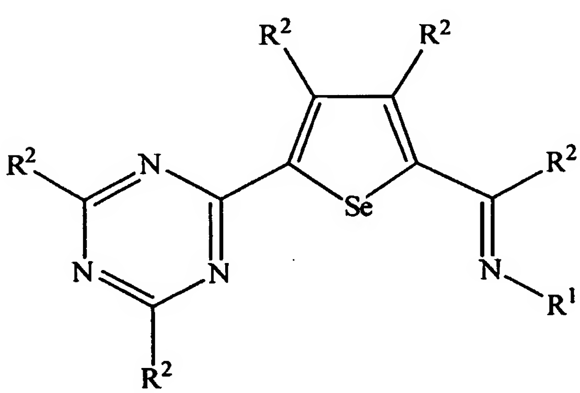
L*68



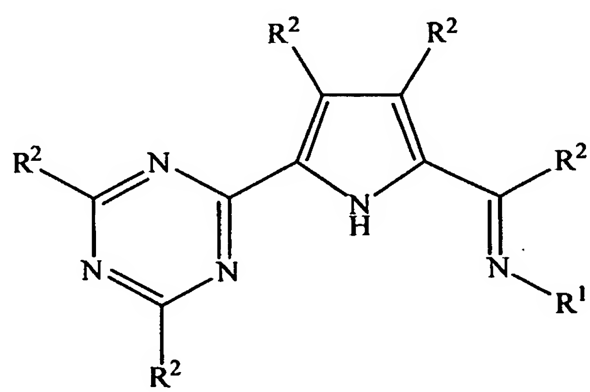
L*69



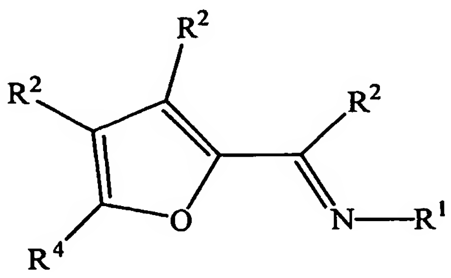
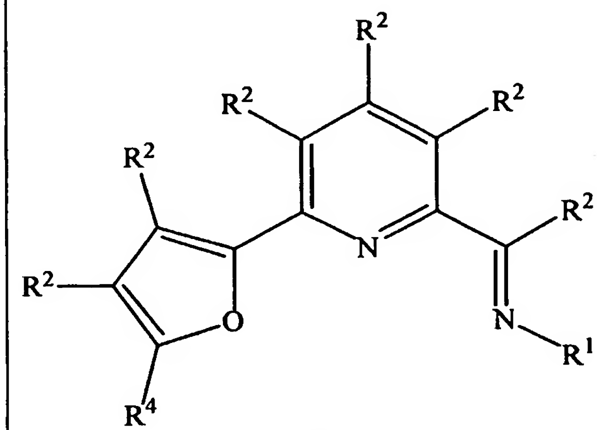
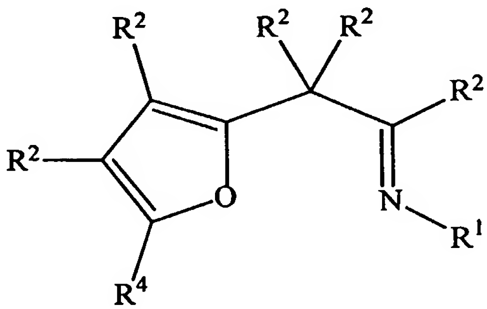
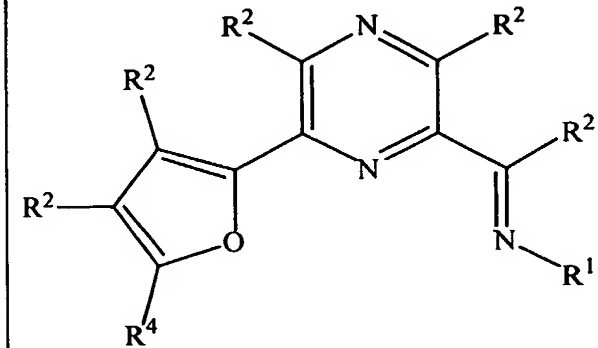
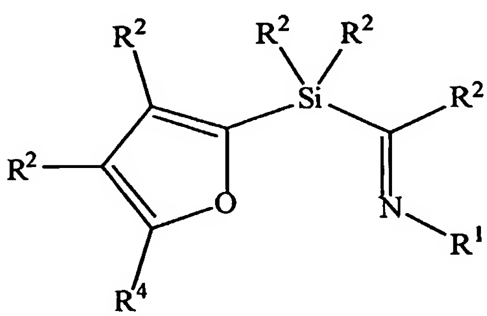
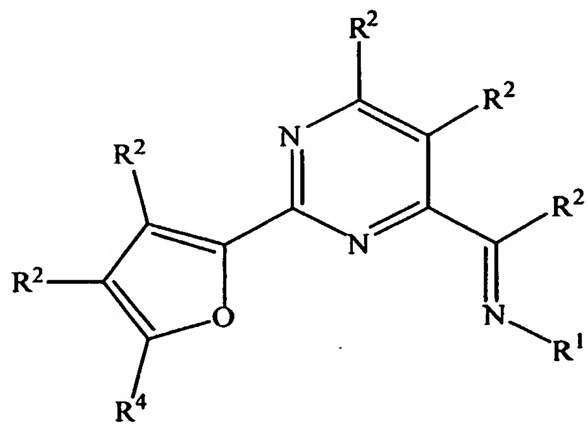
L*70

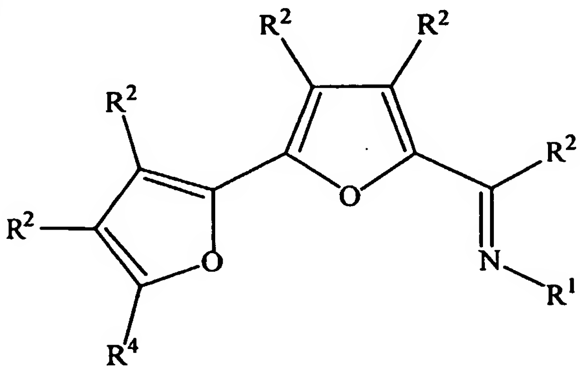


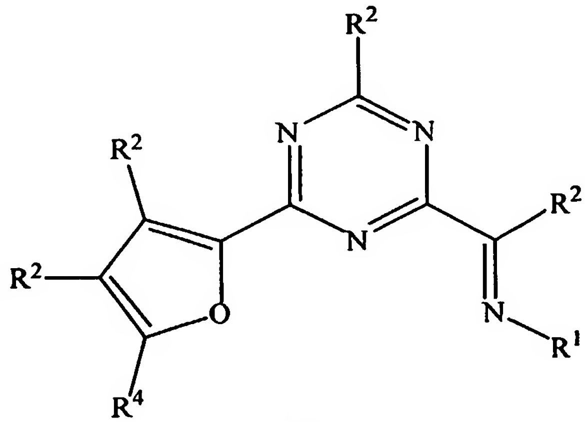
L*71

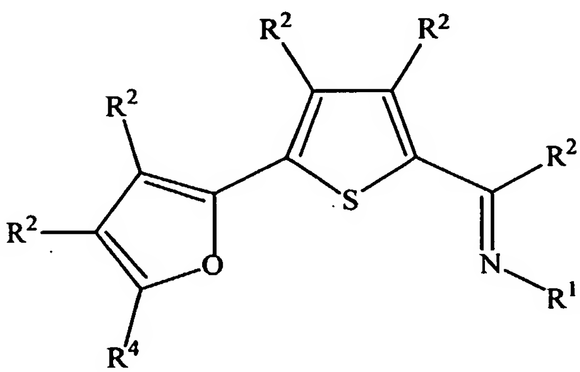


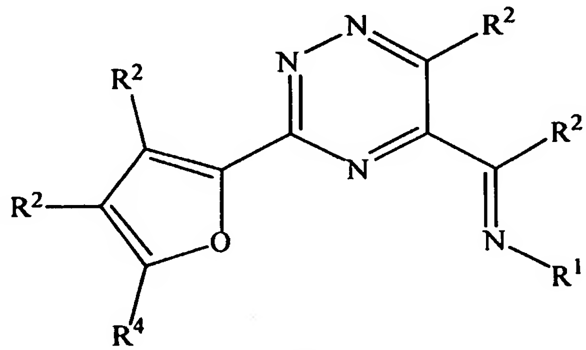
L*72

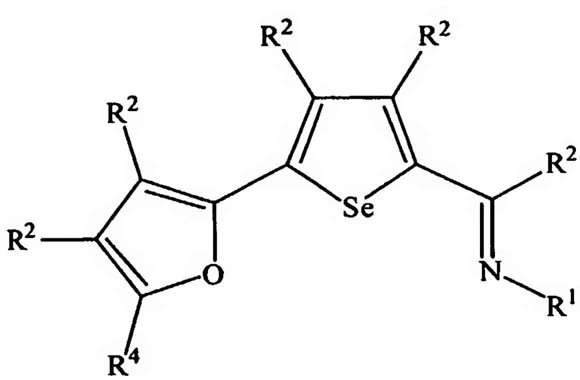
 L*73	 L*74
 L*75	 L*76
 L*77	 L*78

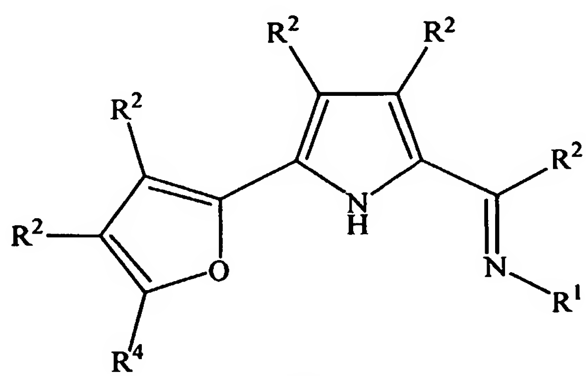

L*79

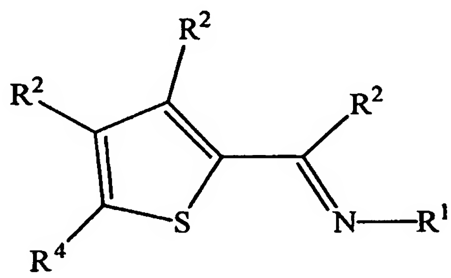

L*80

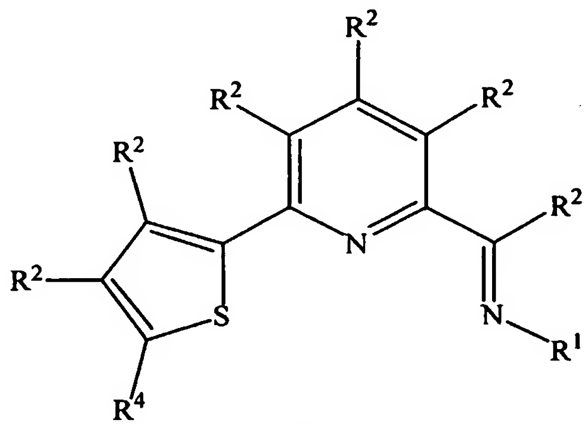

L*81

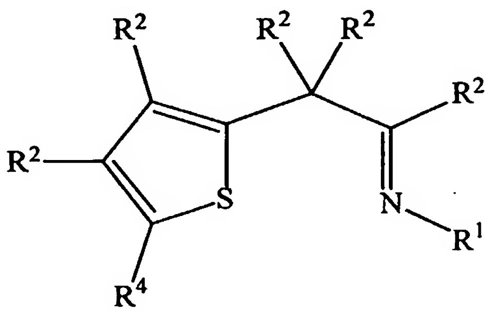

L*82

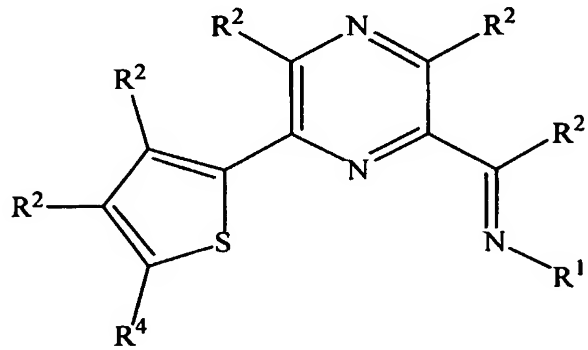

L*83

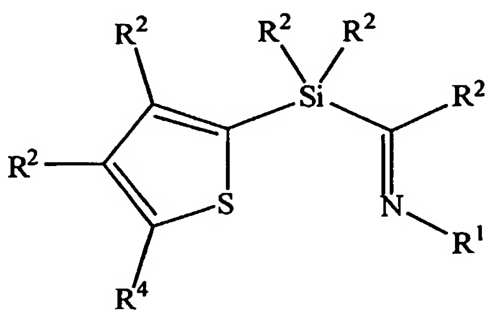

L*84

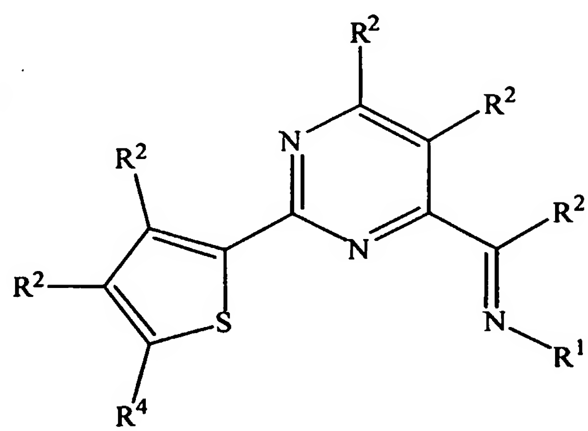

L*85

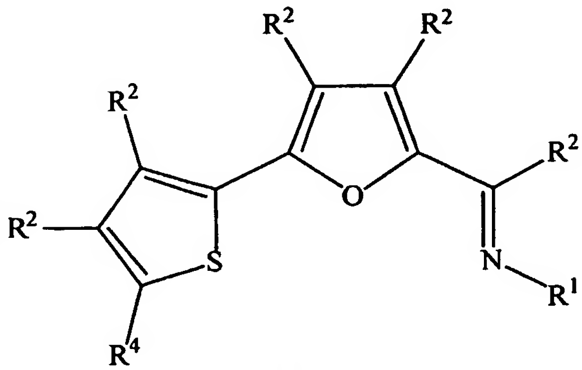

L*86


L*87

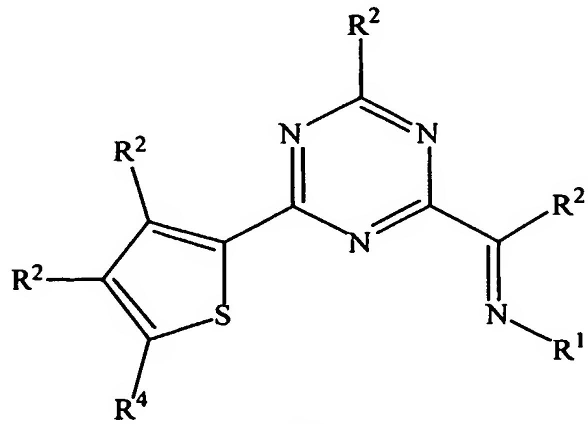

L*88


L*89

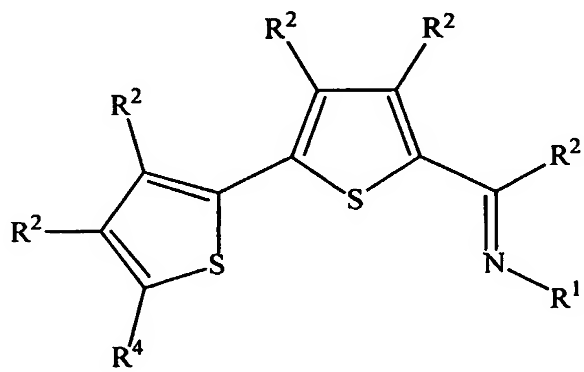

L*90



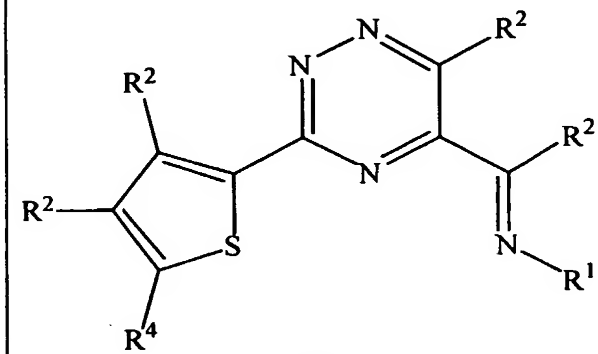
L*91



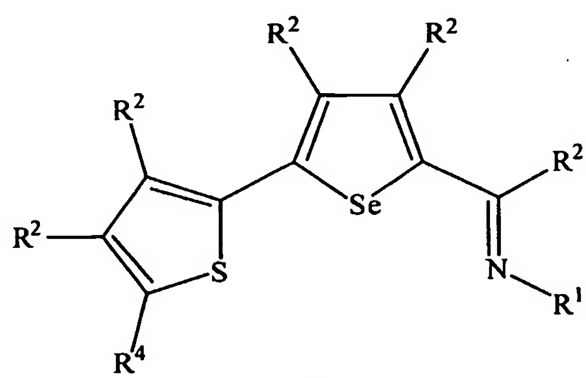
L*92



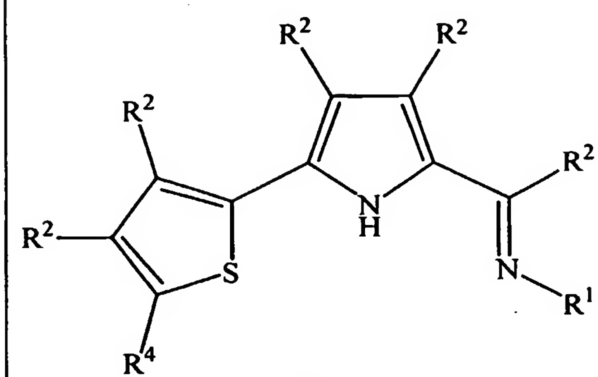
L*93



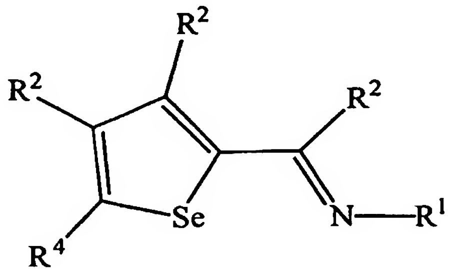
L*94



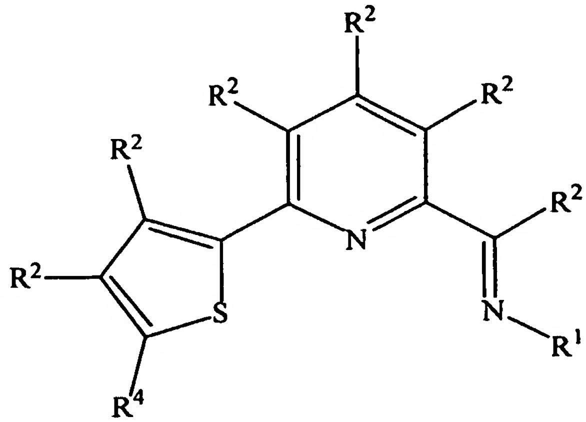
L*95



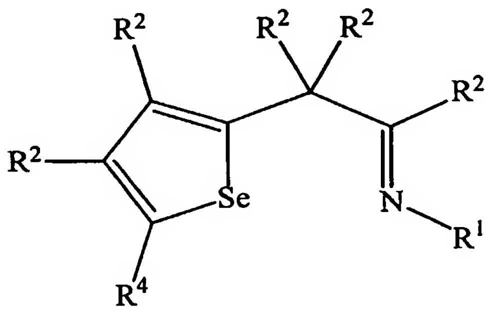
L*96



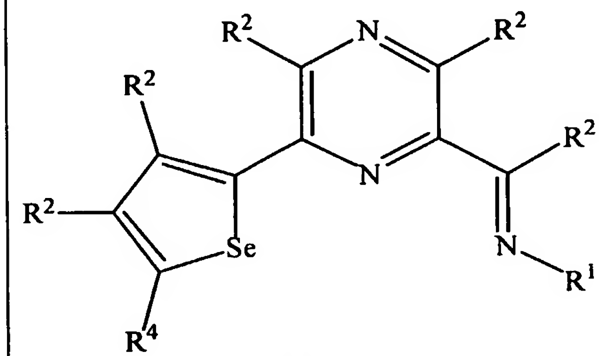
L*97



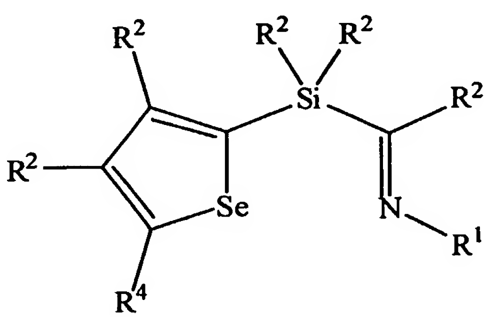
L*98



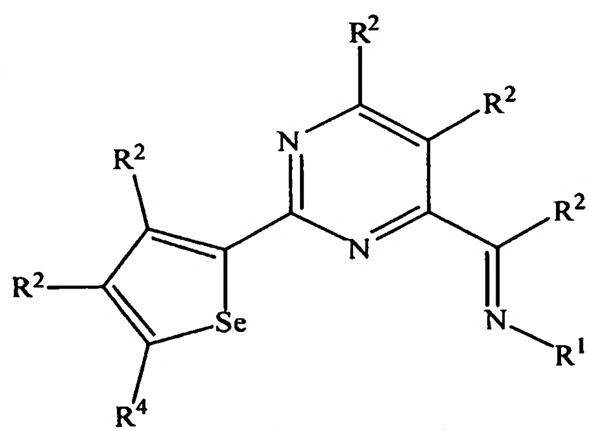
L*99



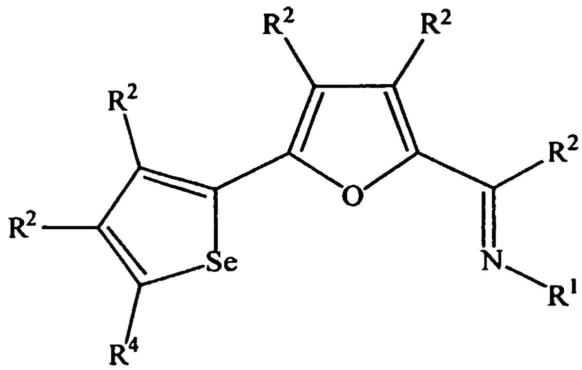
L*100



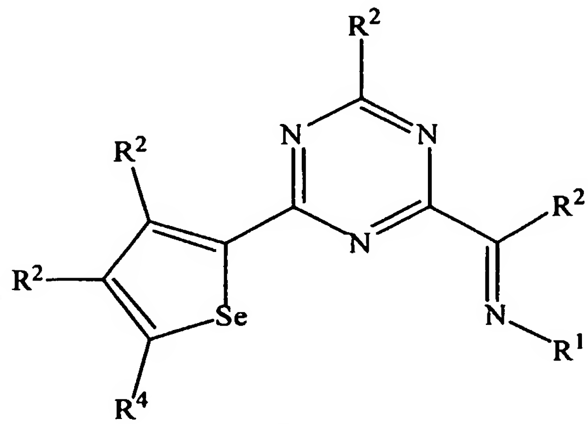
L*101



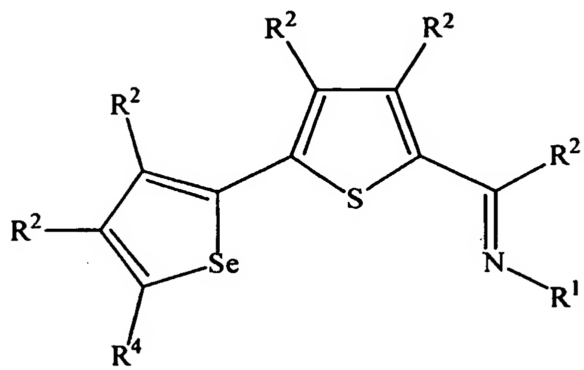
L*102



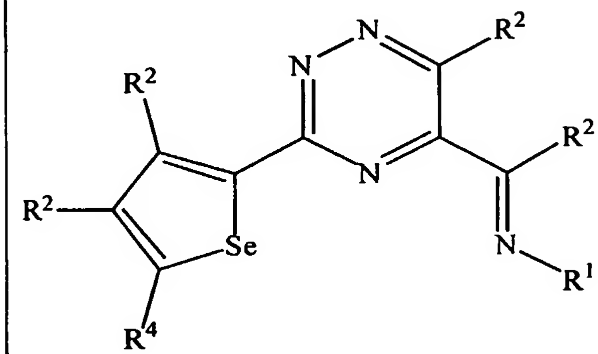
L*103



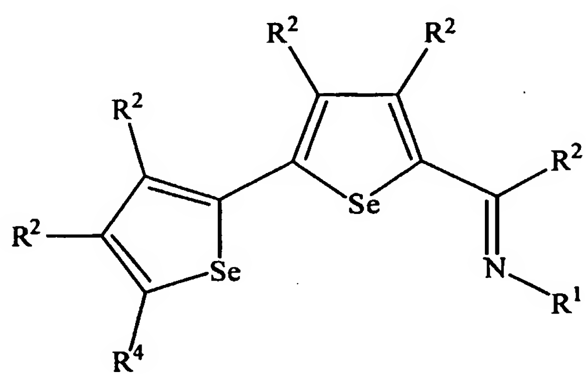
L*104



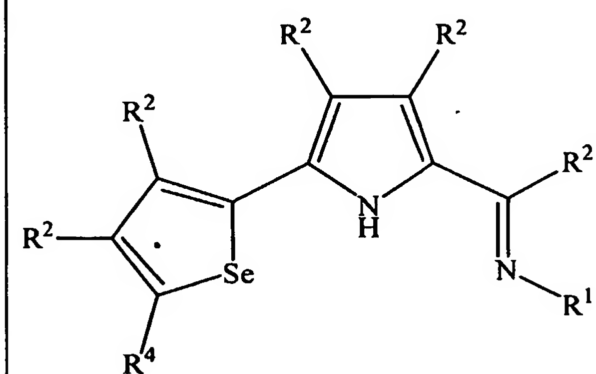
L*105



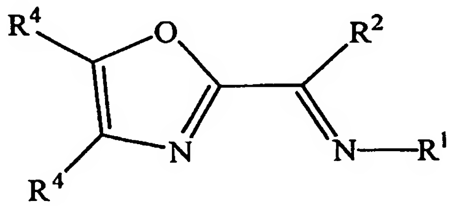
L*106



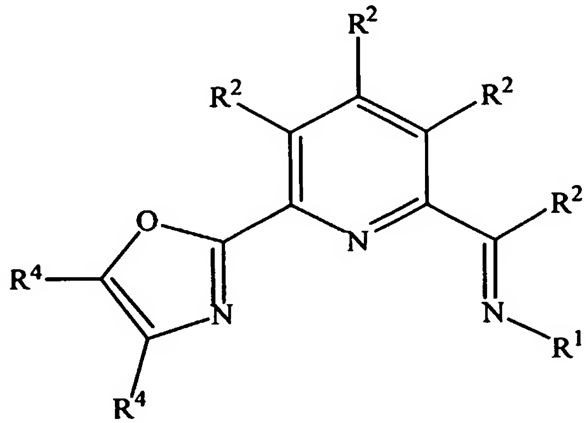
L*107



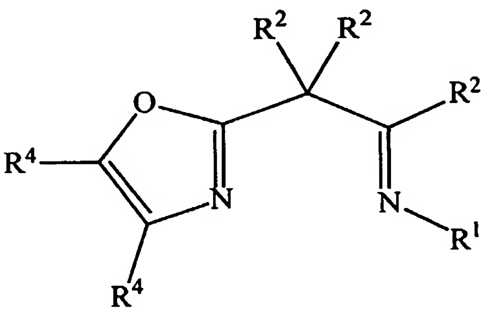
L*108



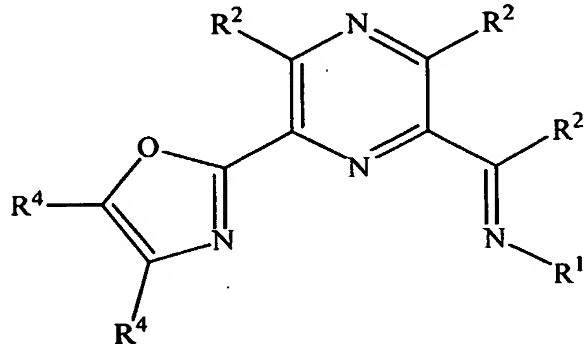
L*109



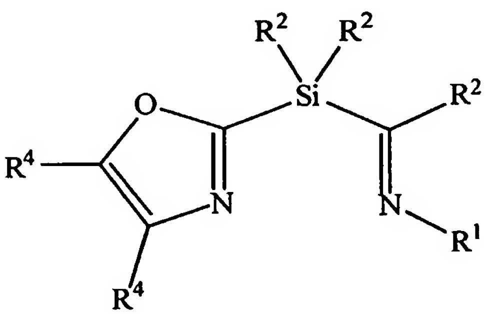
L*110



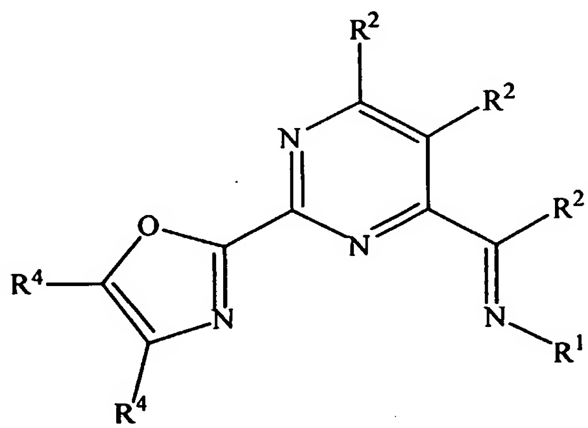
L*111



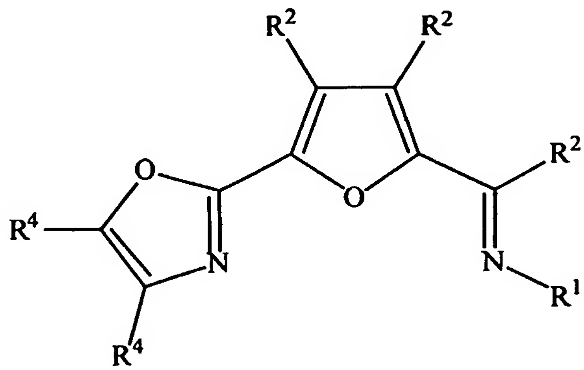
L*112



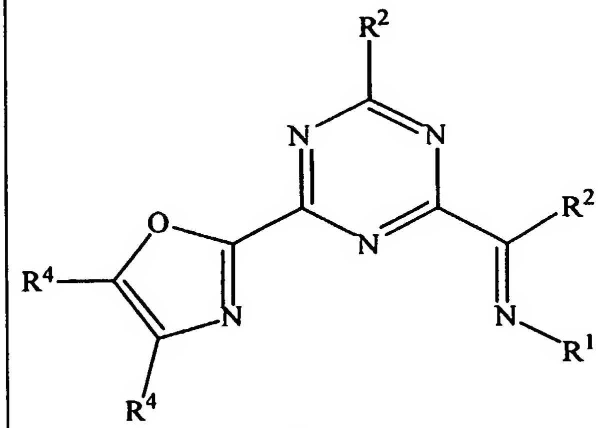
L*113



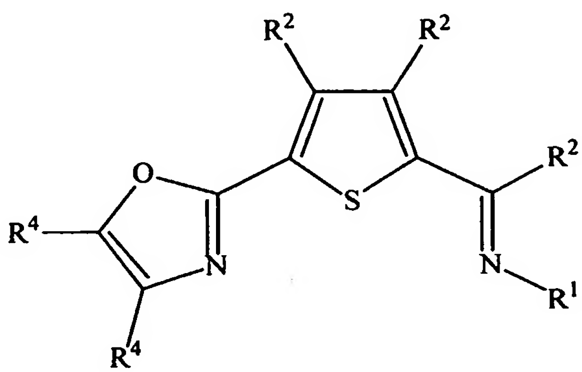
L*114



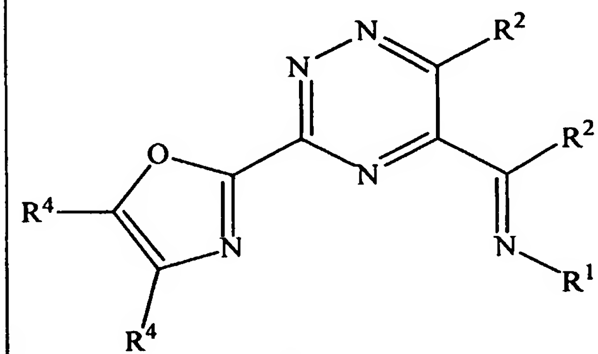
L*115



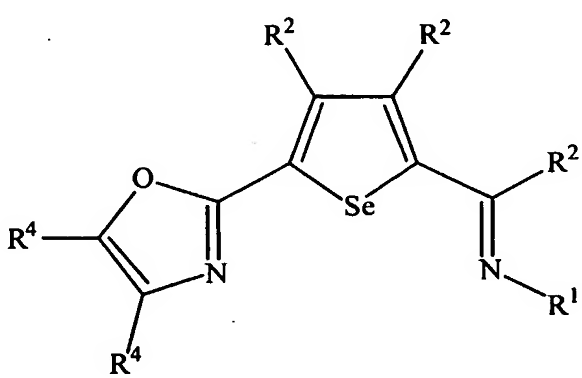
L*116



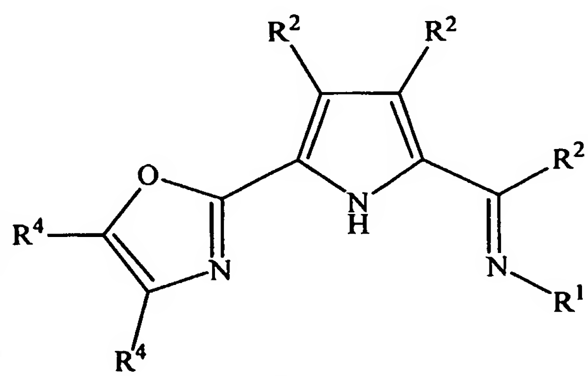
L*117



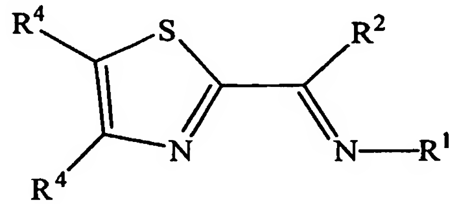
L*118



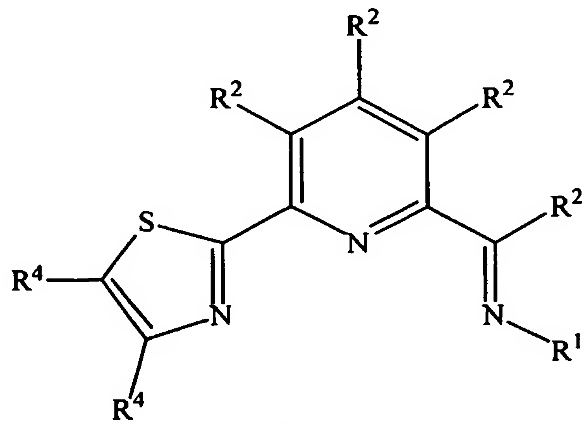
L*119



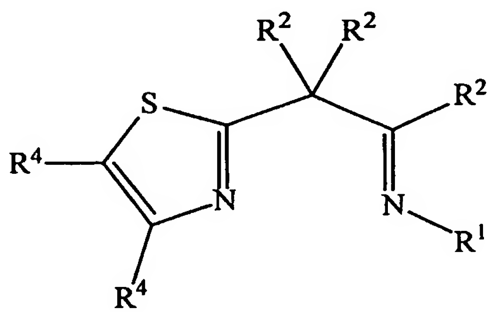
L*120



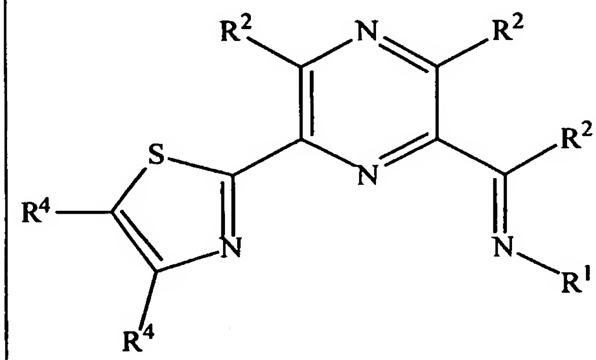
L*121



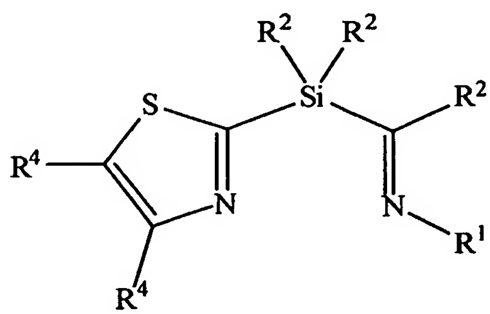
L*122



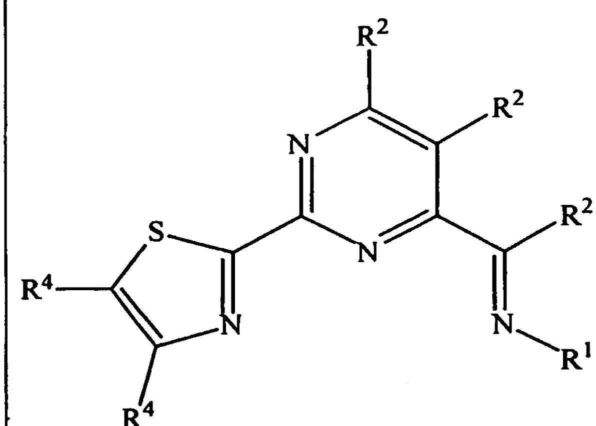
L*123



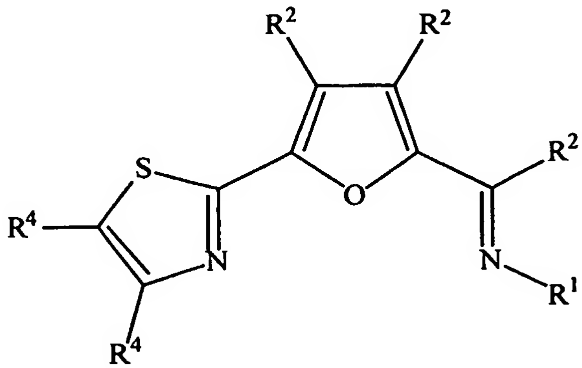
L*124



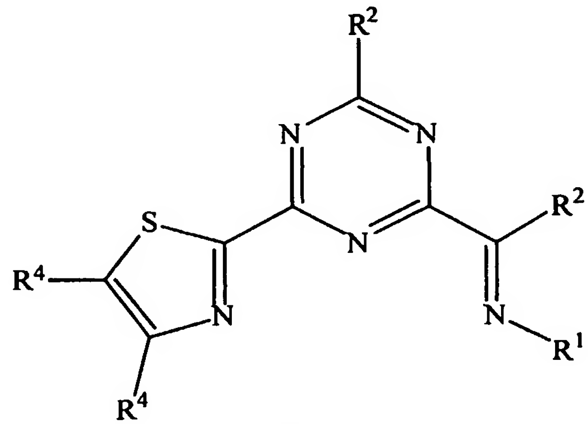
L*125



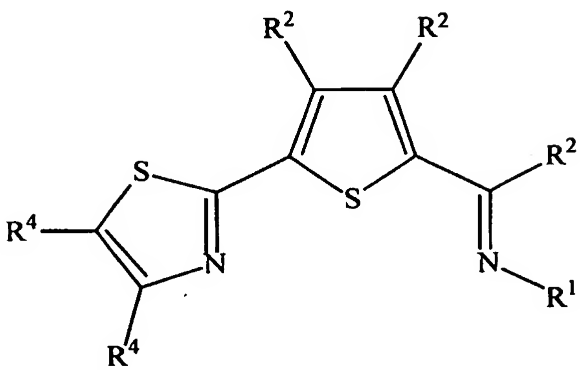
L*126



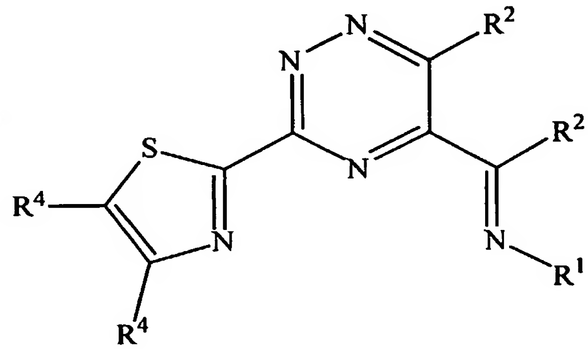
L*127



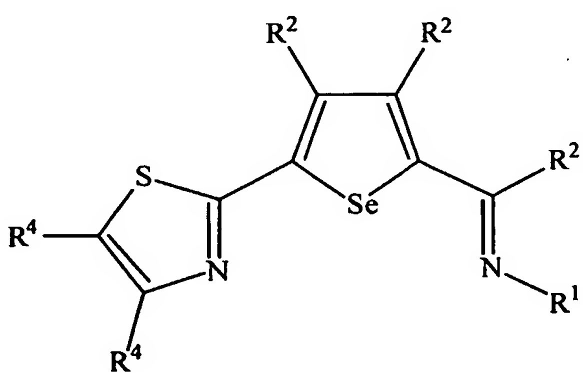
L*128



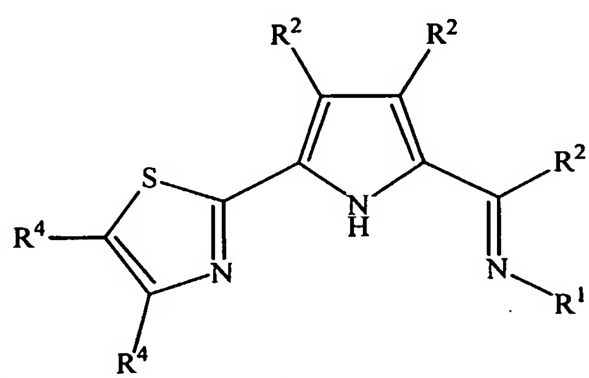
L*129



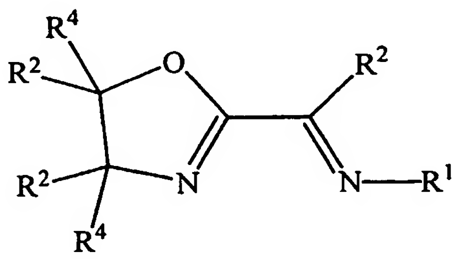
L*130



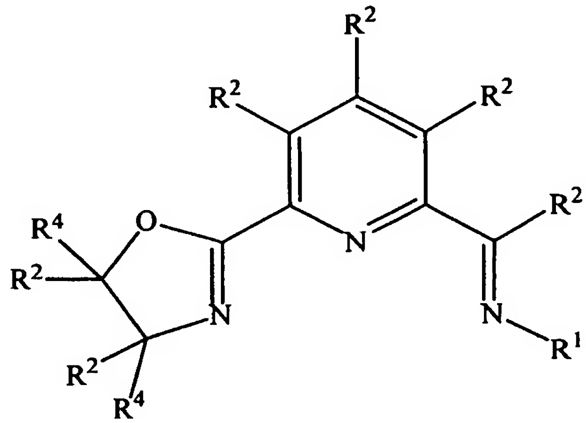
L*131



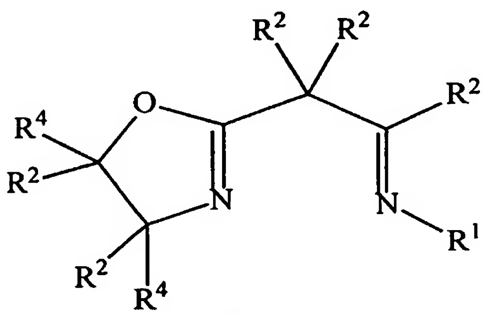
L*132



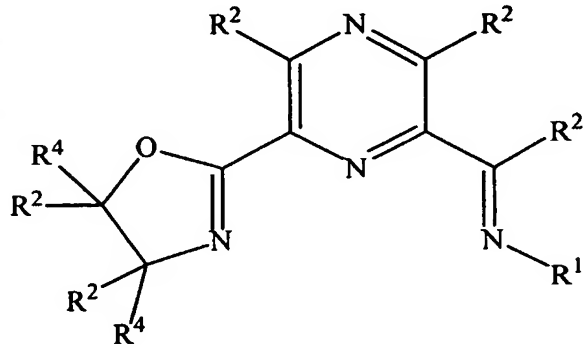
L*133



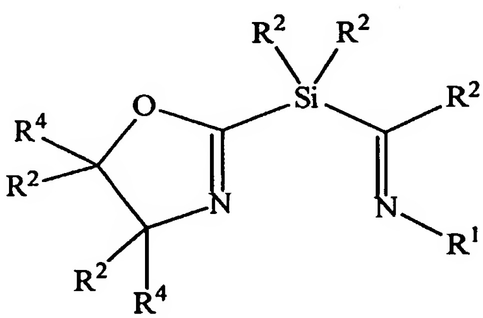
L*134



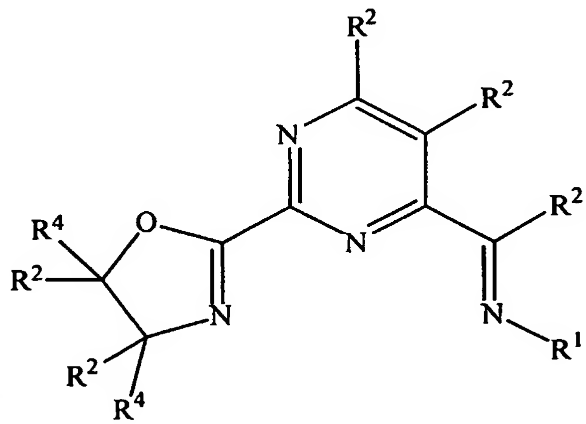
L*135



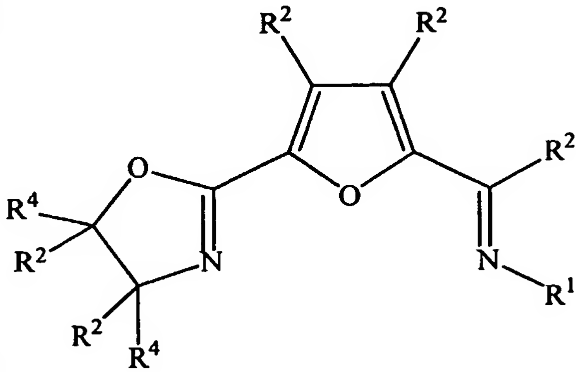
L*136



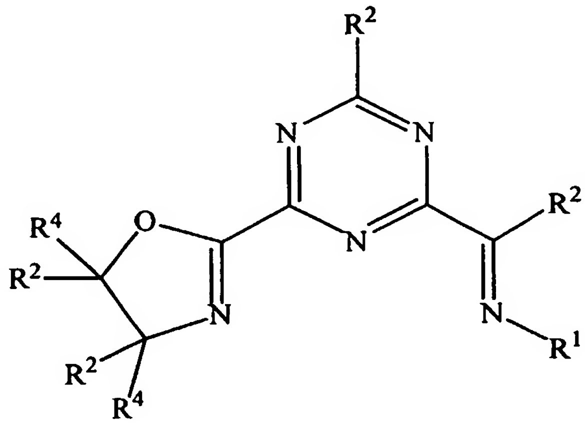
L*137



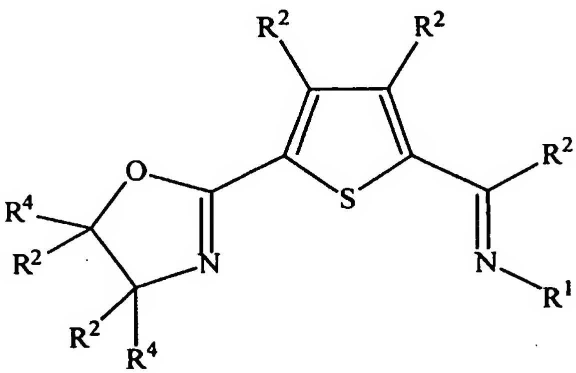
L*138



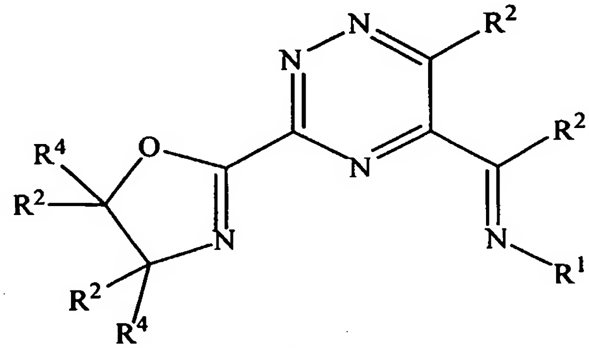
L*139



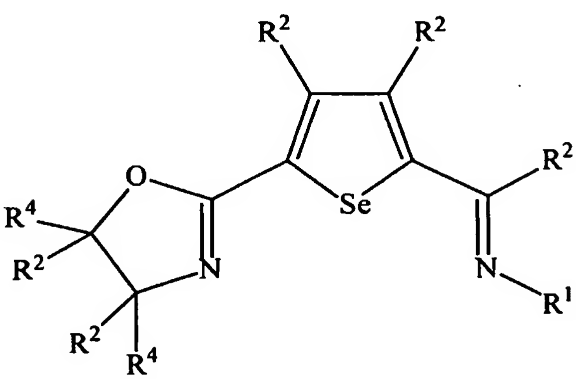
L*140



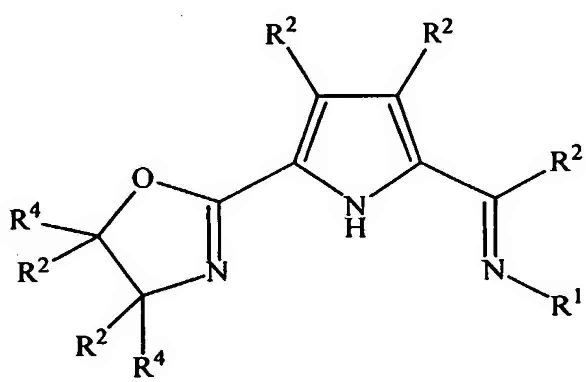
L*141



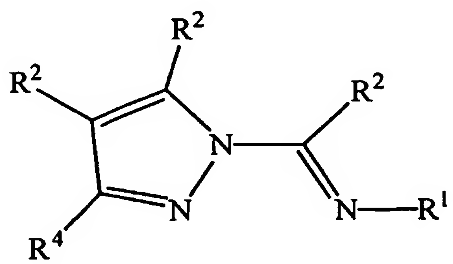
L*142



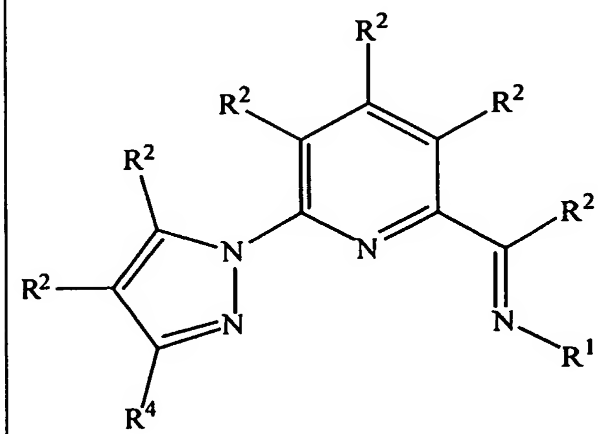
L*143



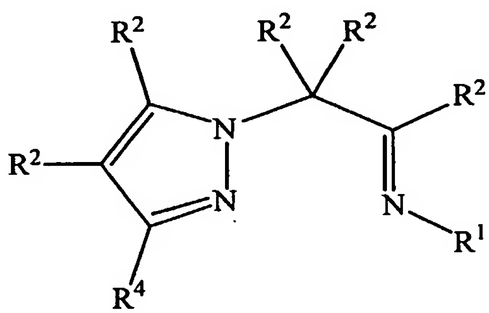
L*144



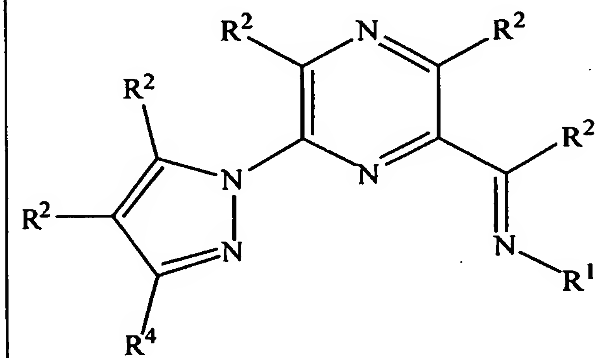
L*145



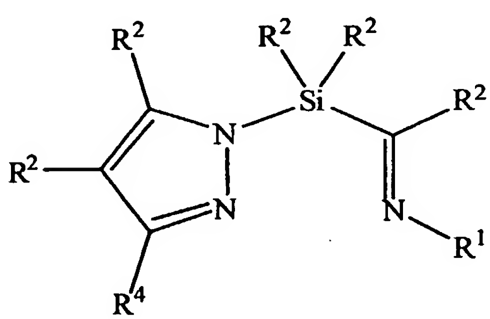
L*146



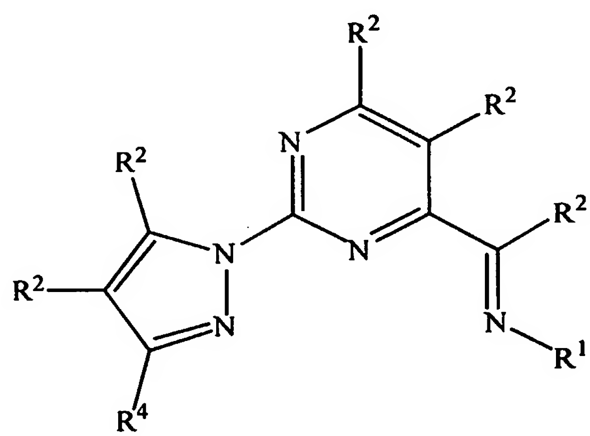
L*147



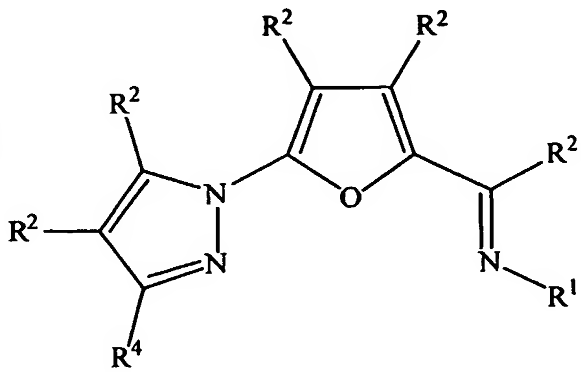
L*148



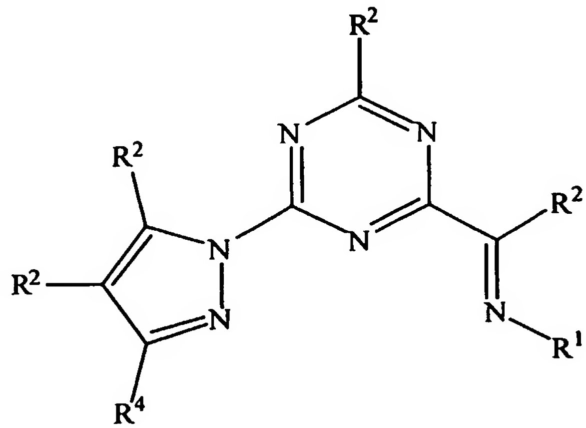
L*149



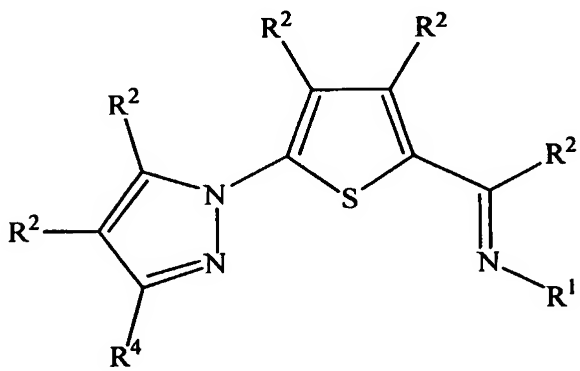
L*150



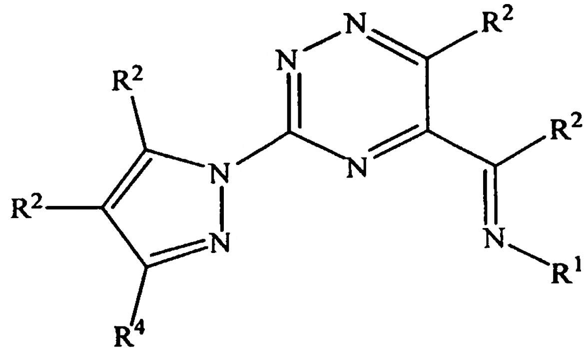
L*151



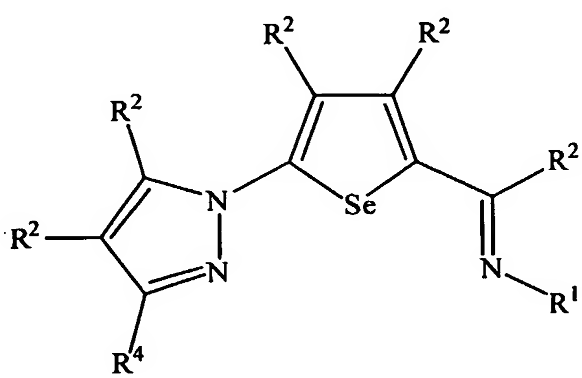
L*152



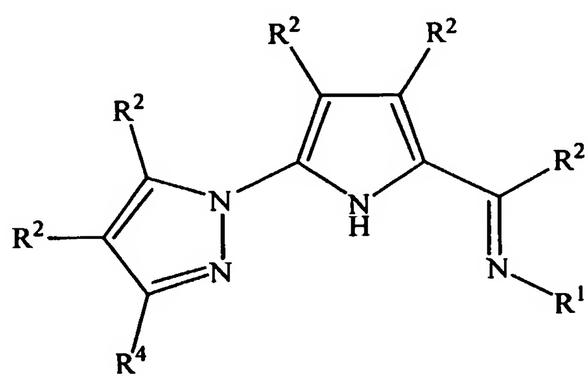
L*153



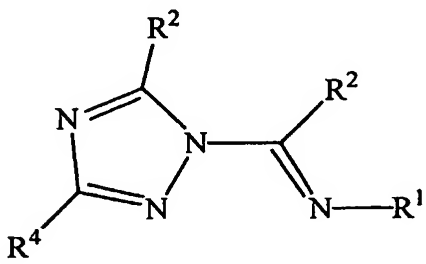
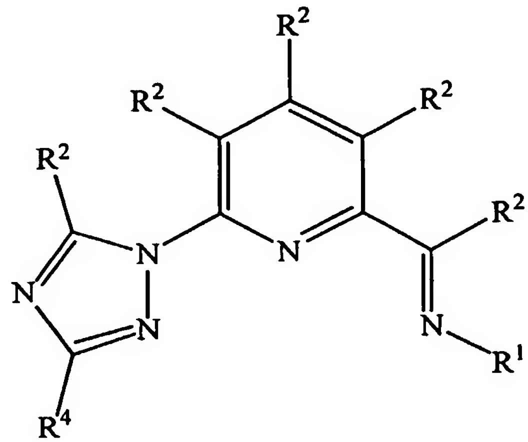
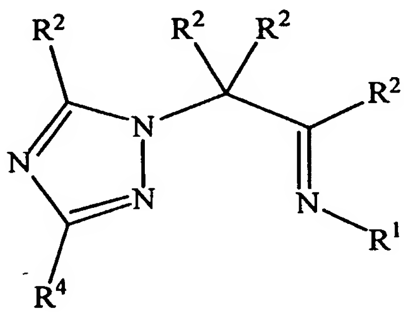
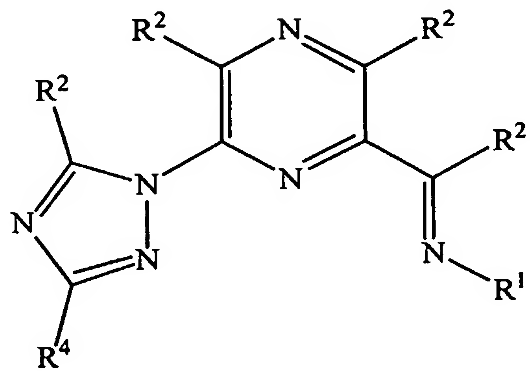
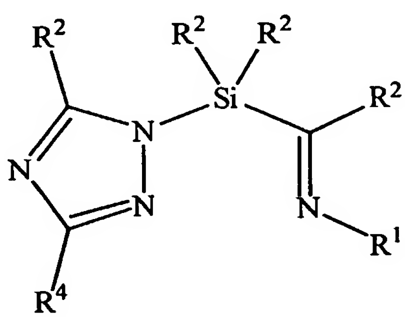
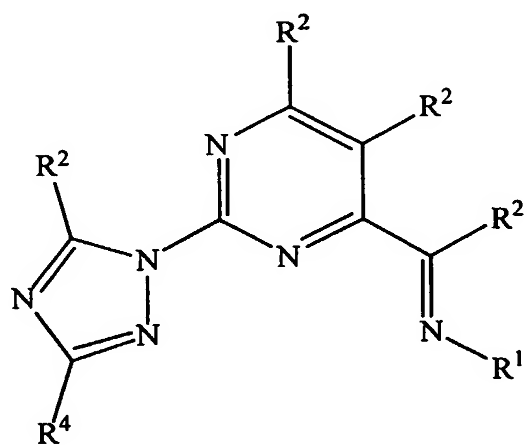
L*154

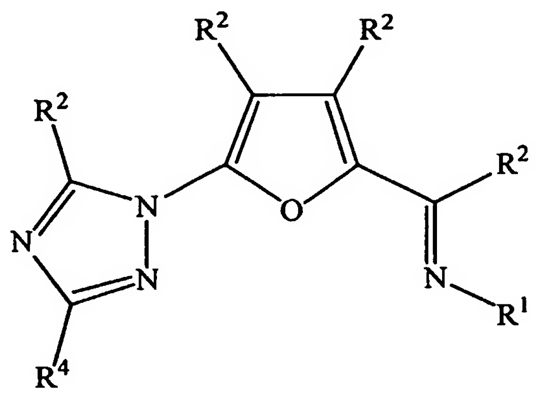


L*155

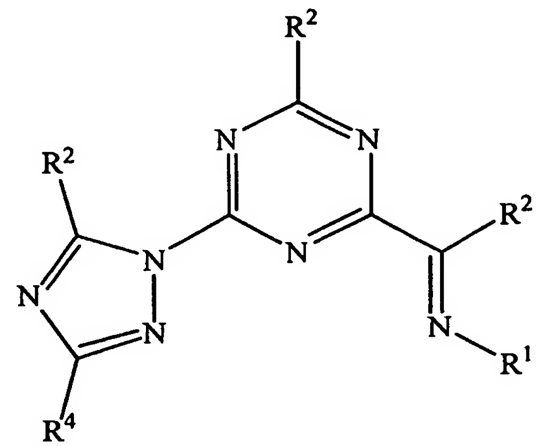


L*156

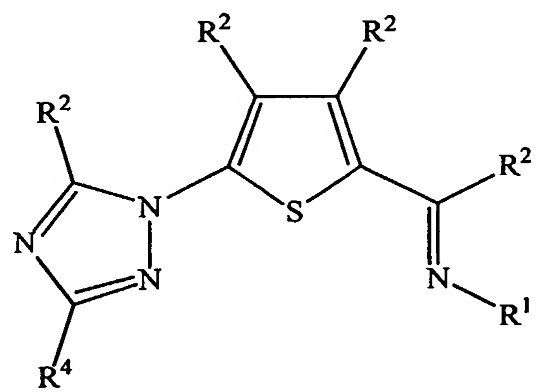
 L*157	 L*158
 L*159	 L*160
 L*161	 L*162



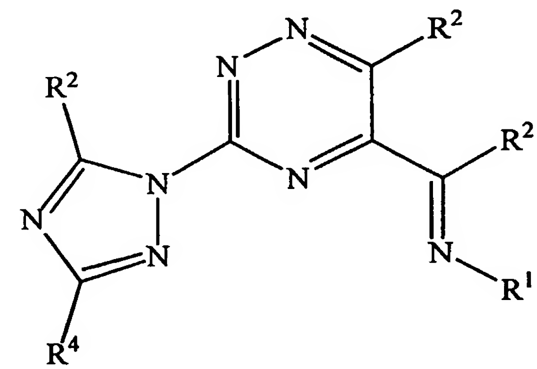
L*163



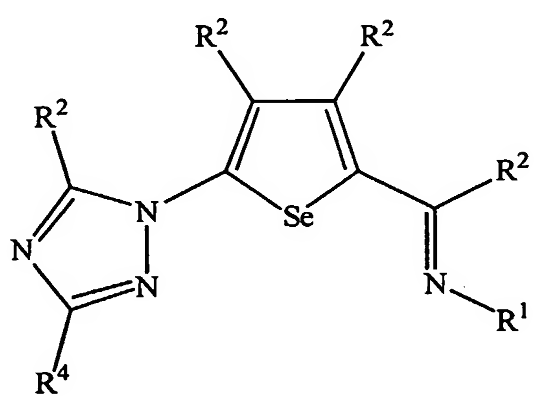
L*164



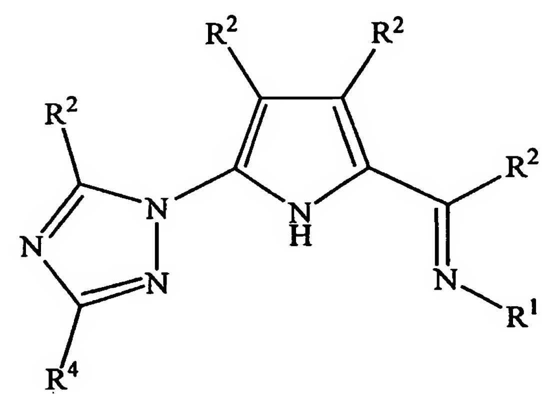
L*165



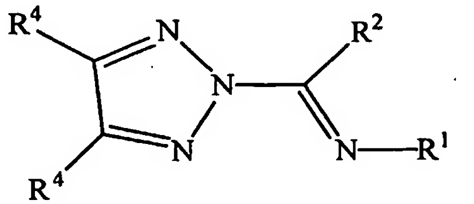
L*166



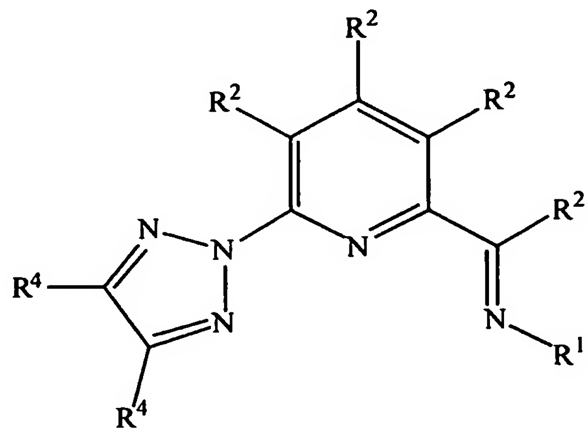
L*167



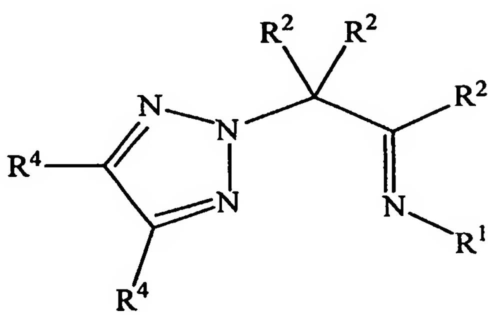
L*168



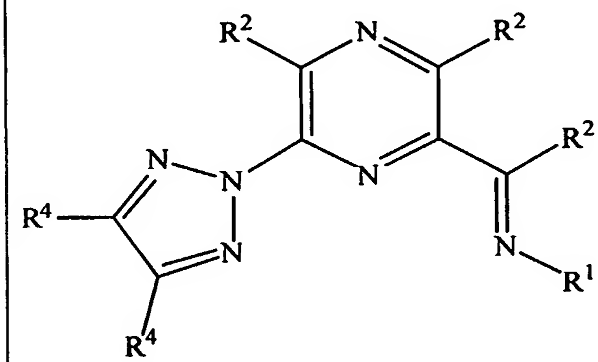
L*169



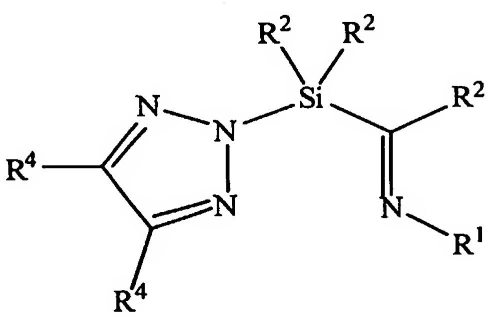
L*170



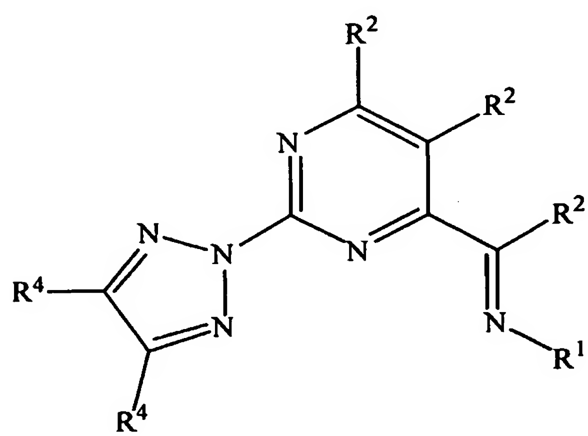
L*171



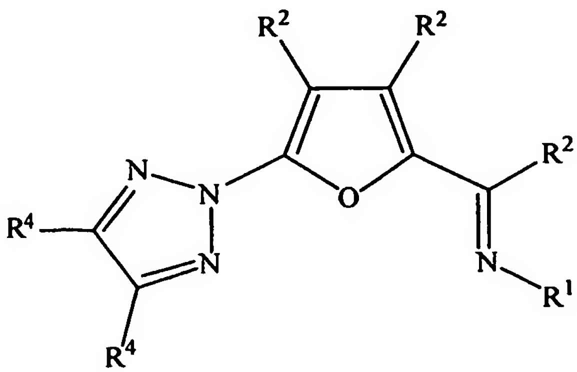
L*172



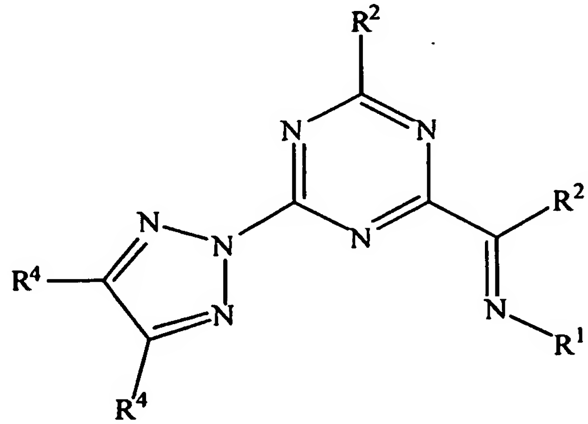
L*173



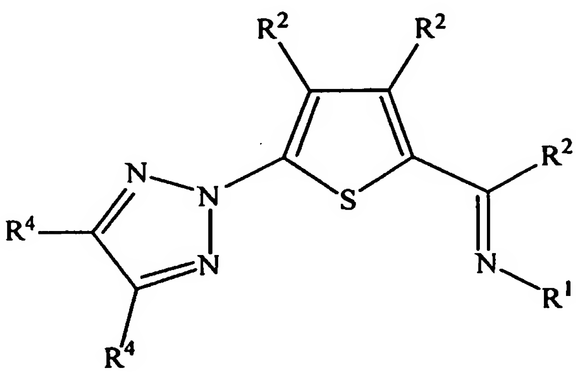
L*174



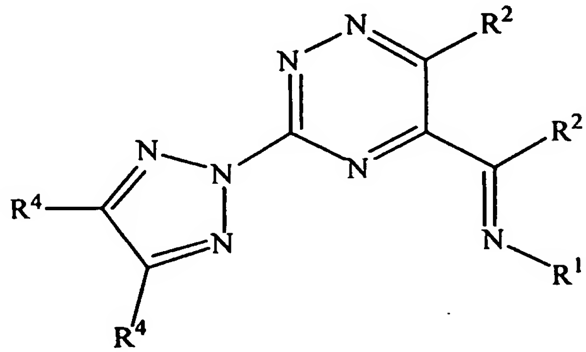
L*175



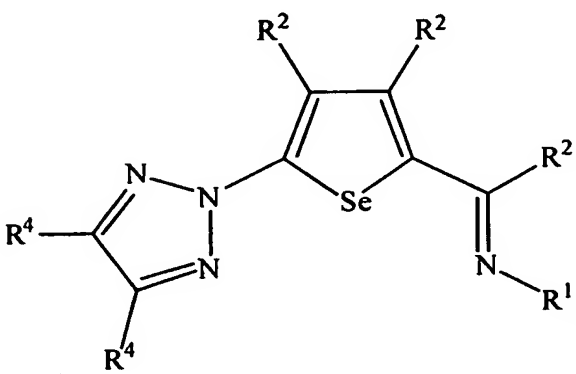
L*176



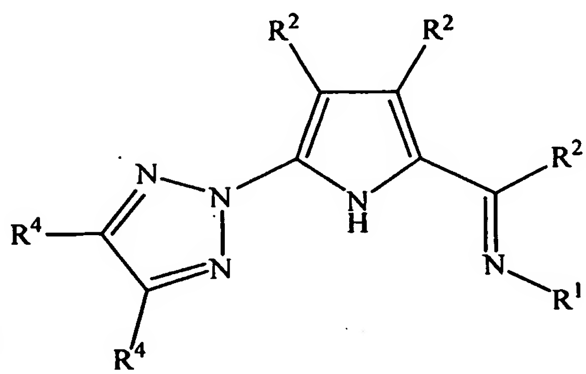
L*177



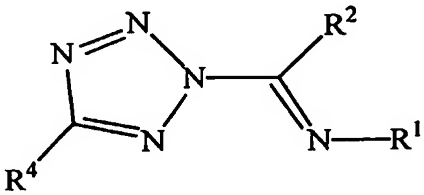
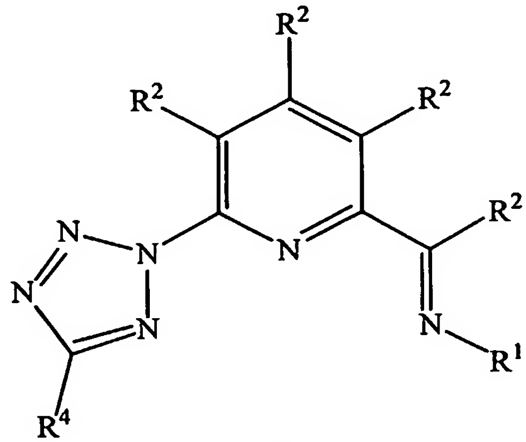
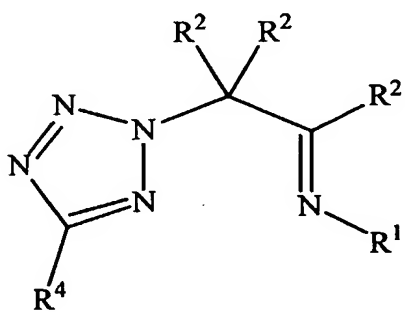
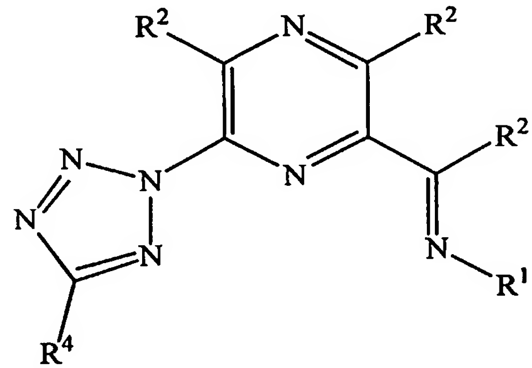
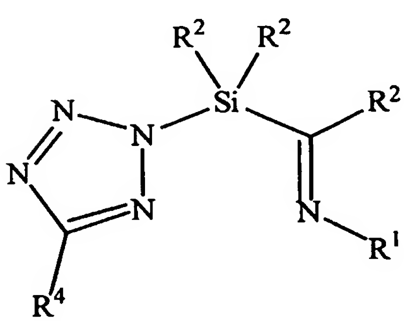
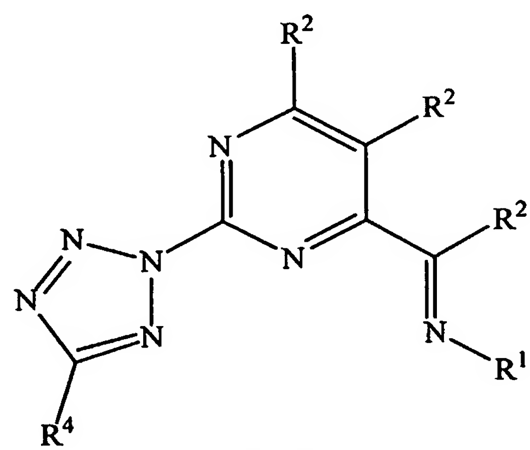
L*178

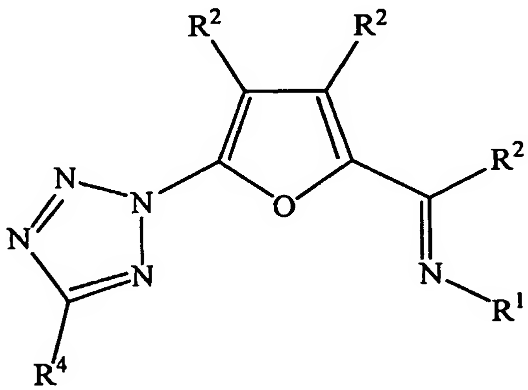
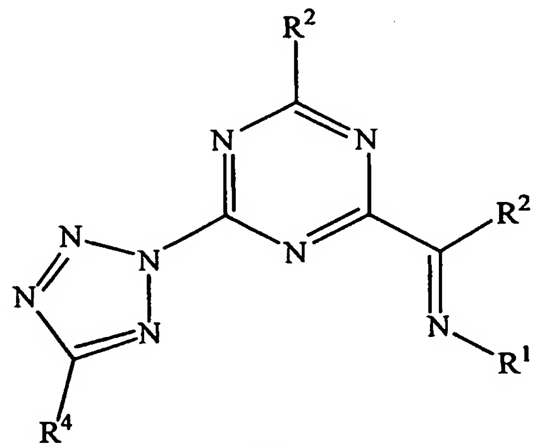
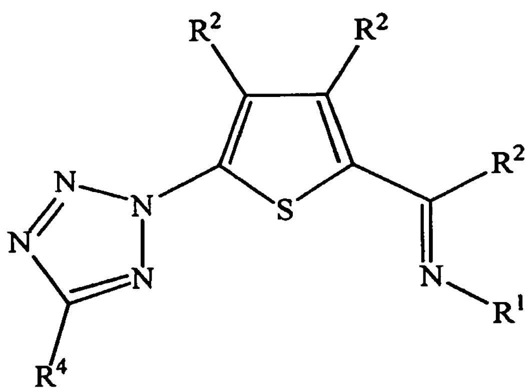
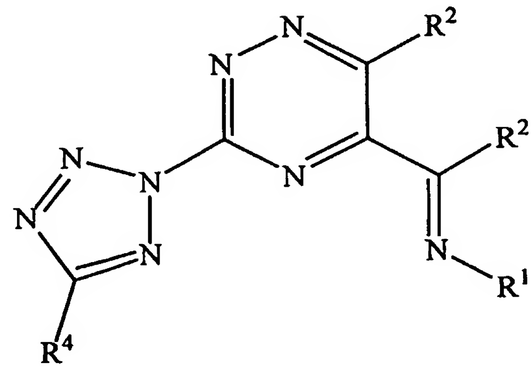
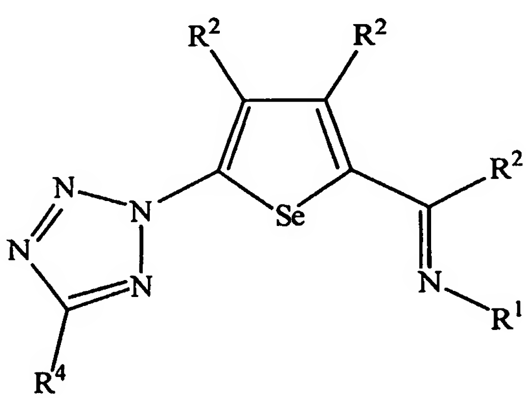
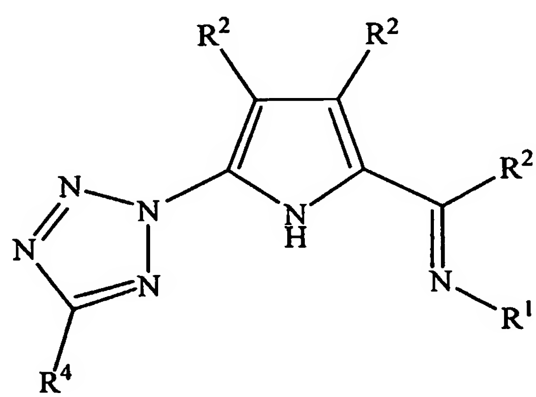


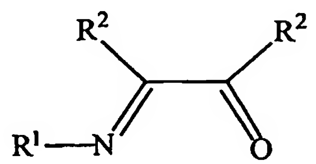
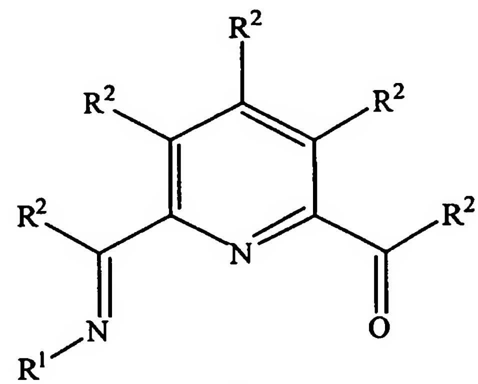
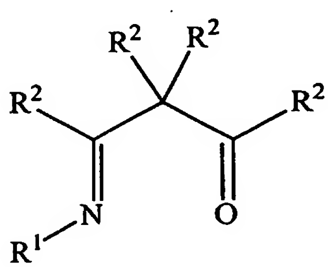
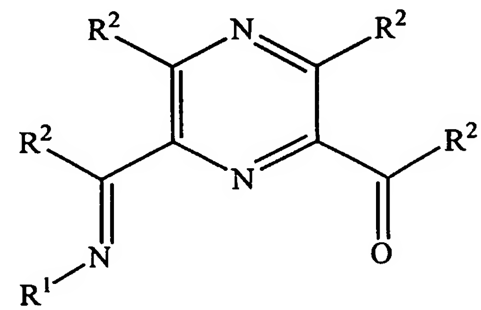
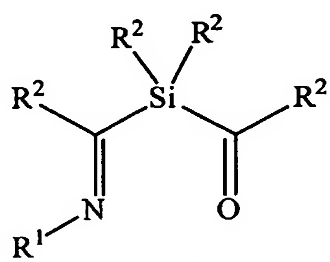
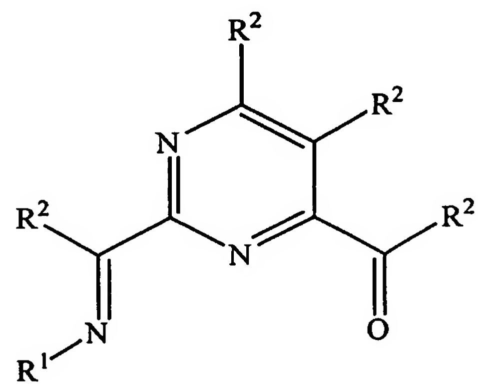
L*179

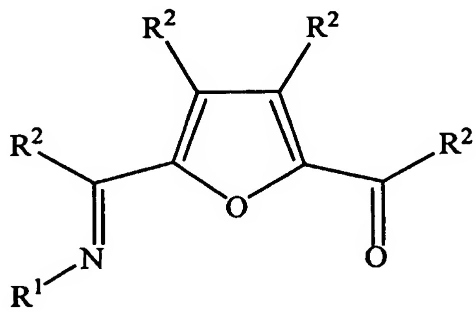
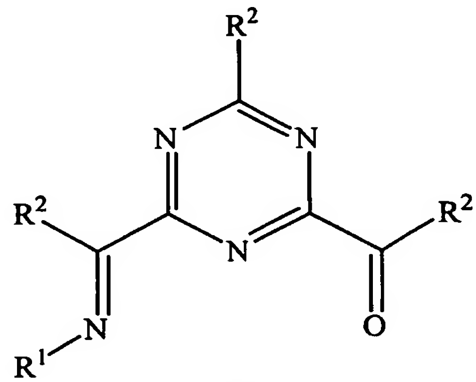
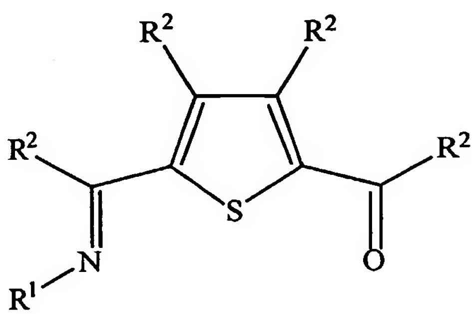
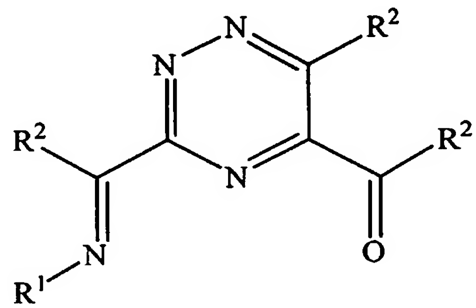
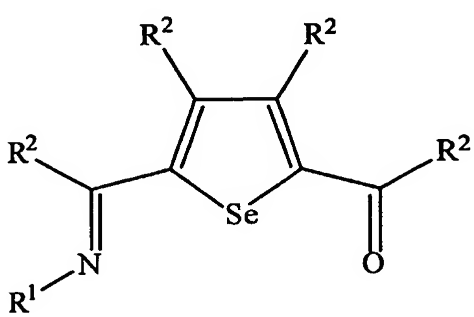
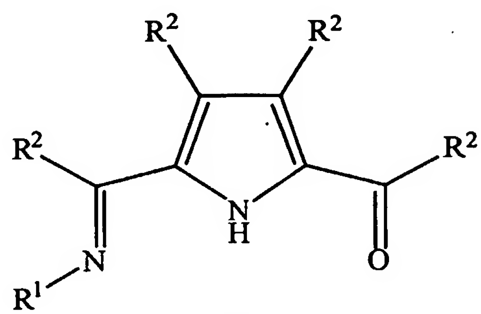


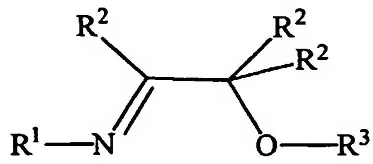
L*180

 L*181	 L*182
 L*183	 L*184
 L*185	 L*186

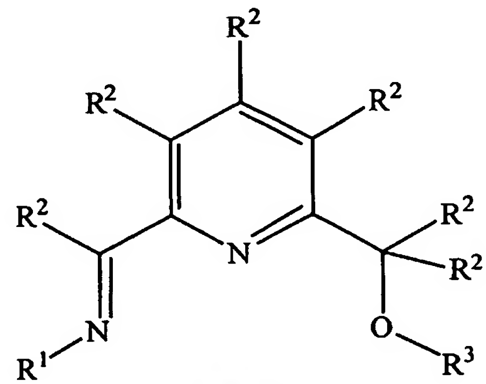
 L*187	 L*188
 L*189	 L*190
 L*191	 L*192

 L*193	 L*194
 L*195	 L*196
 L*197	 L*198

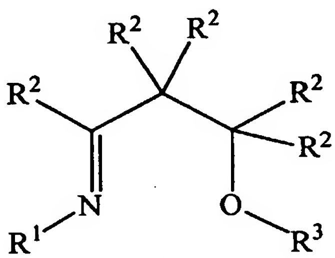
 L*199	 L*200
 L*201	 L*202
 L*203	 L*204



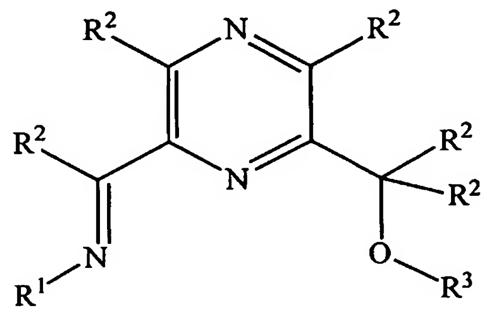
L*205



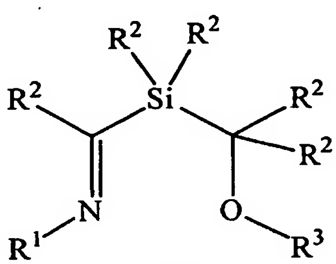
L*206



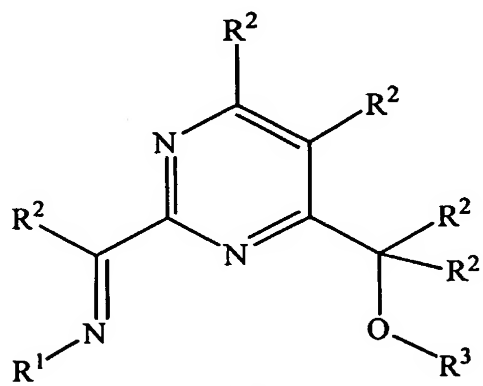
L*207



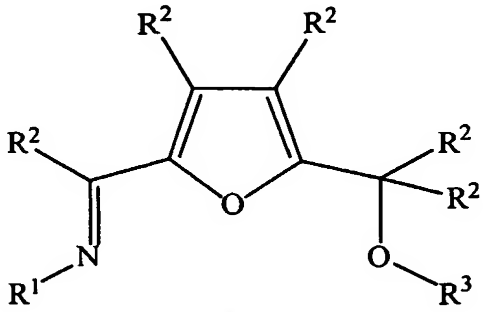
L*208



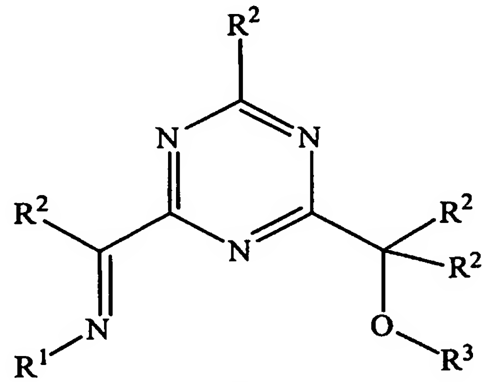
L*209



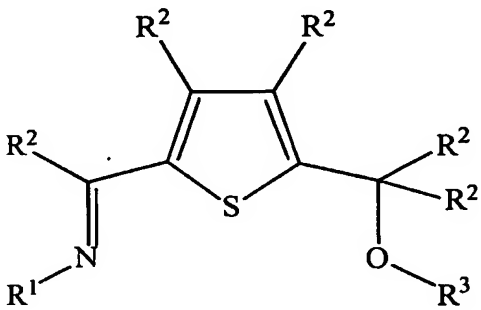
L*210



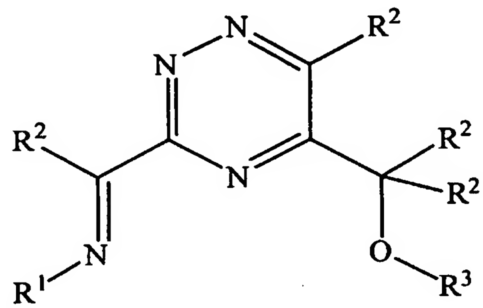
L*211



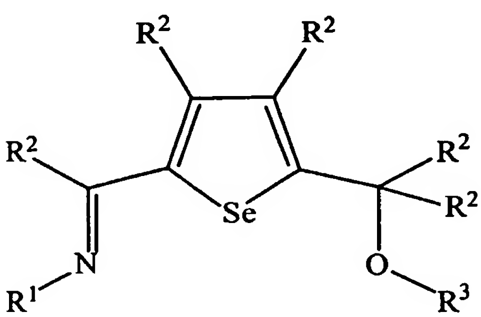
L*212



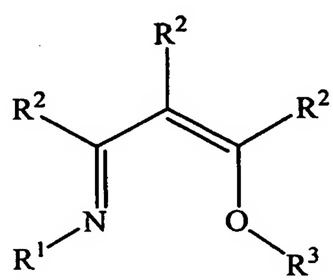
L*213



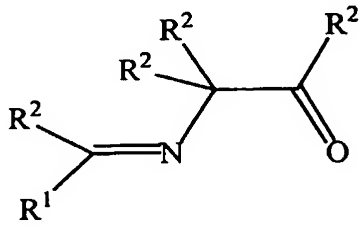
L*214



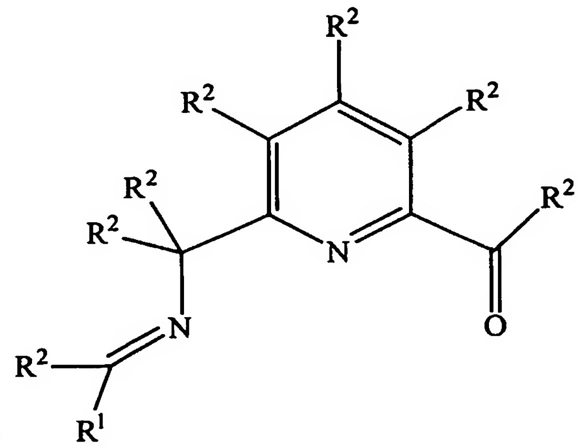
L*215



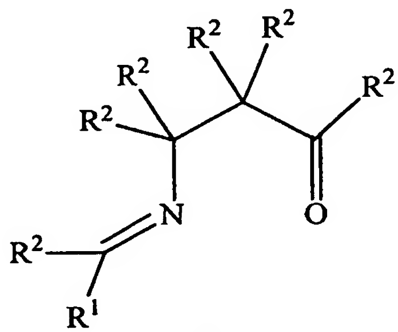
L*216



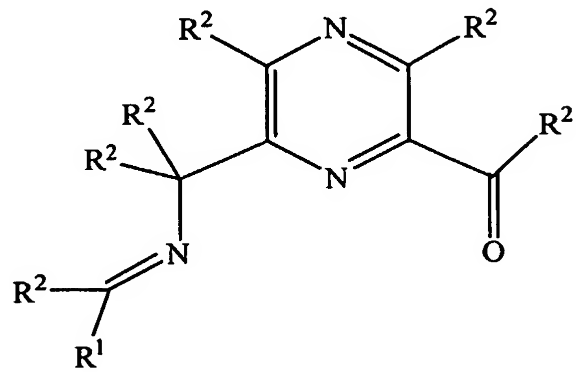
L*217



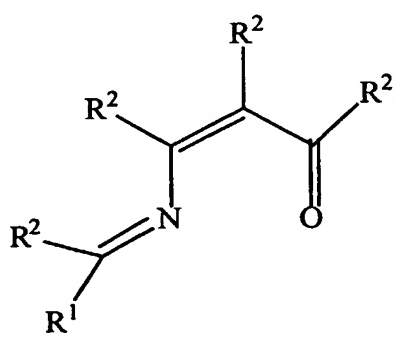
L*218



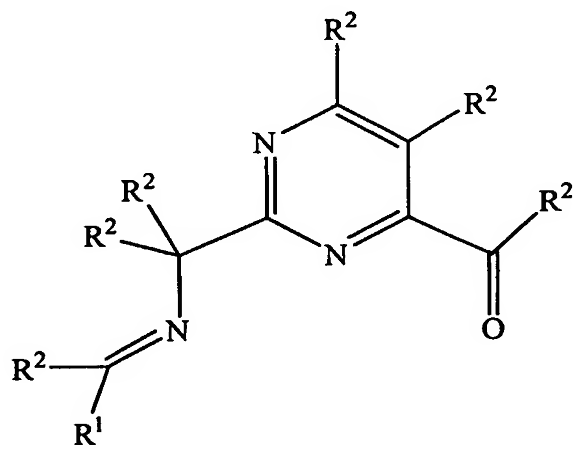
L*219



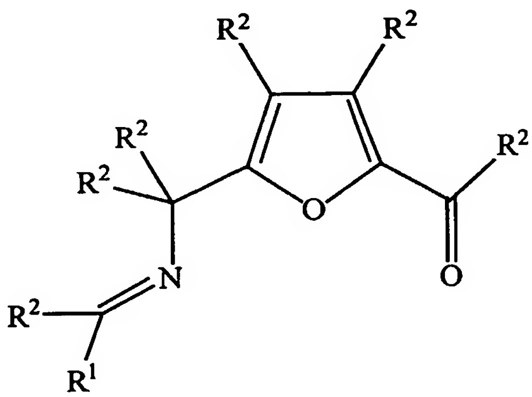
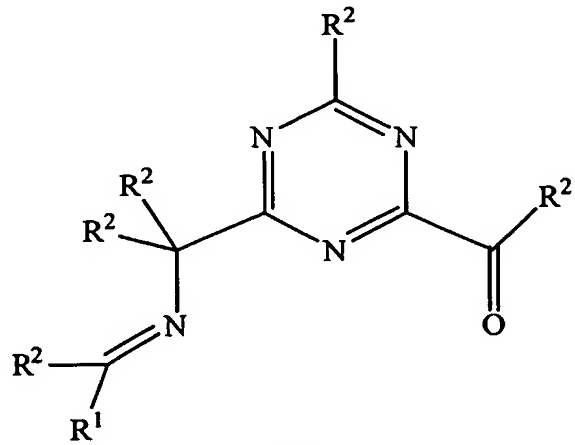
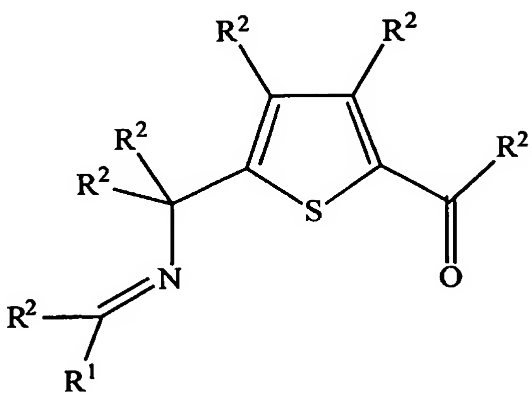
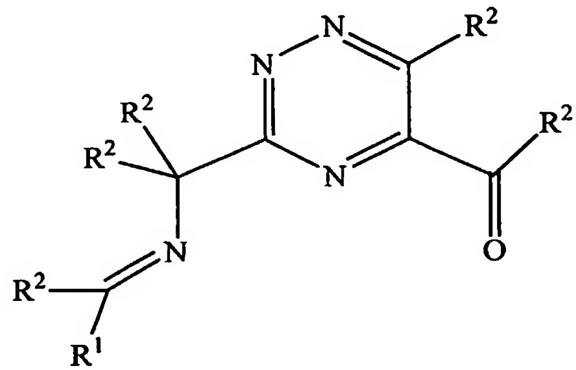
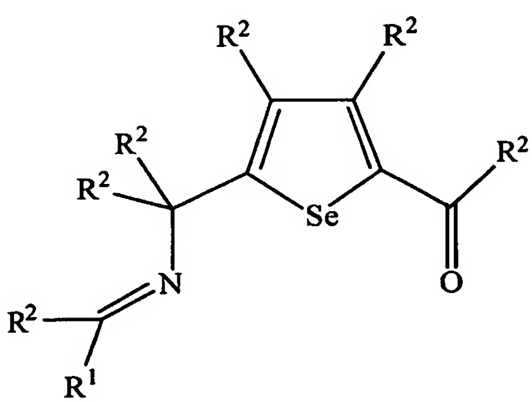
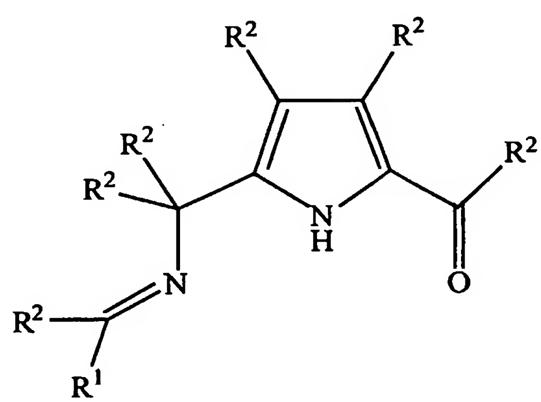
L*220

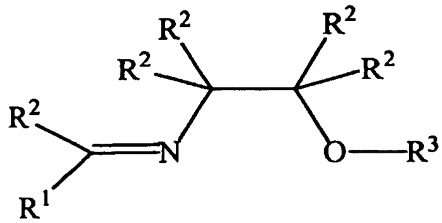


L*221

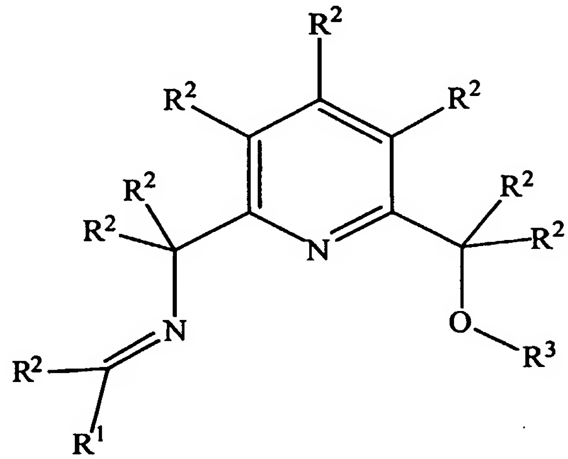


L*222

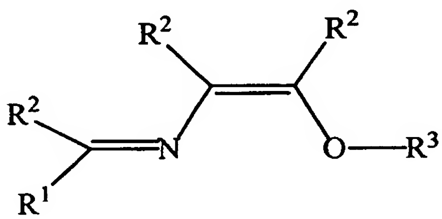
 L*223	 L*224
 L*225	 L*226
 L*227	 L*228



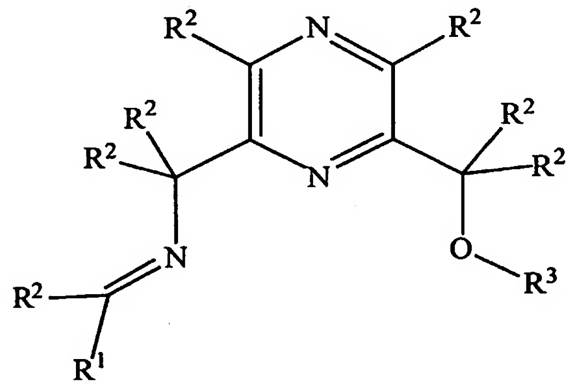
L*229



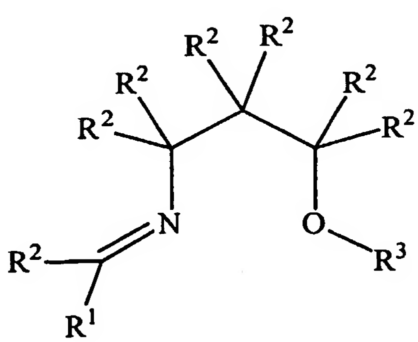
L*230



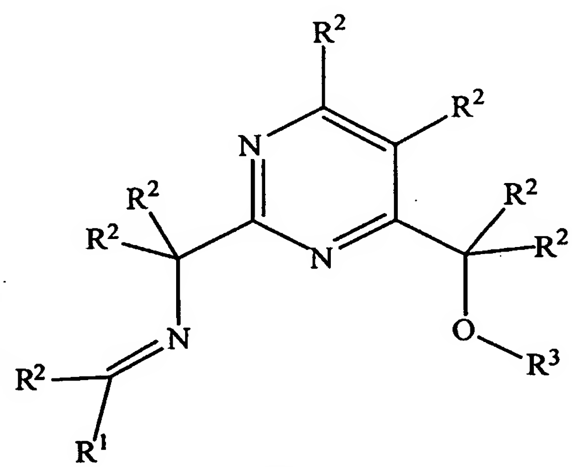
L*231



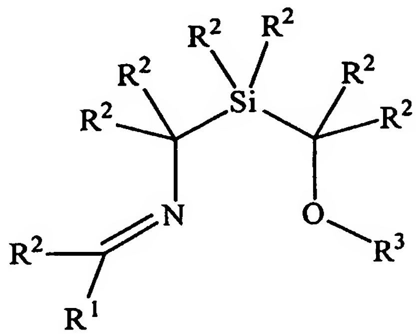
L*232



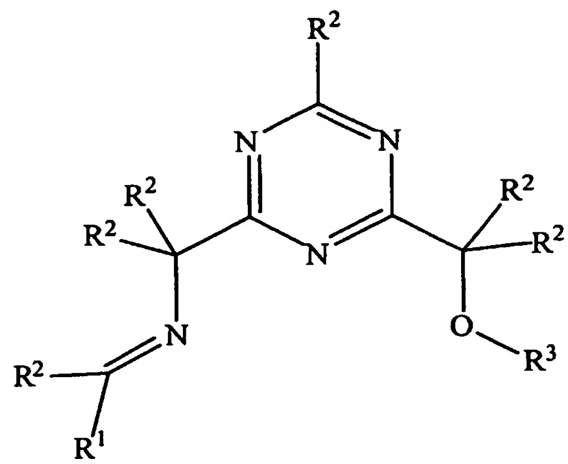
L*233



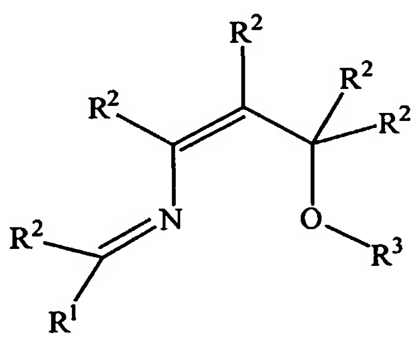
L*234



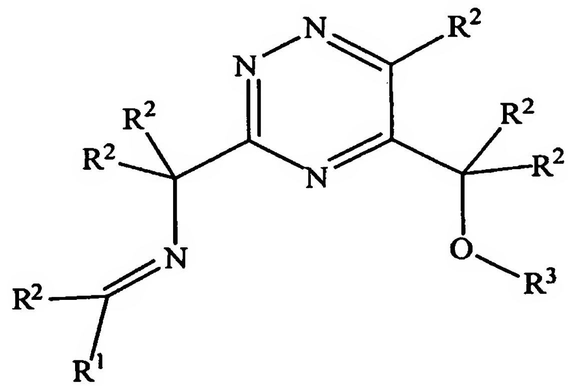
L*235



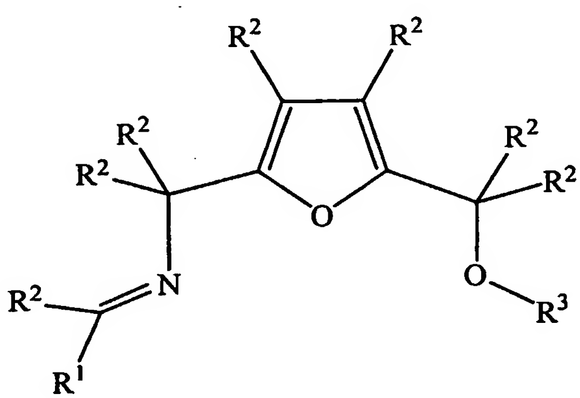
L*236



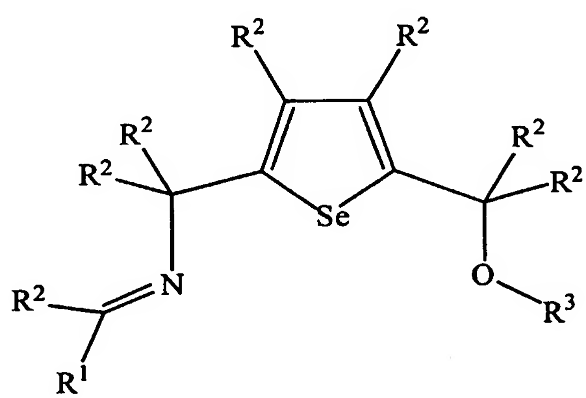
L*237



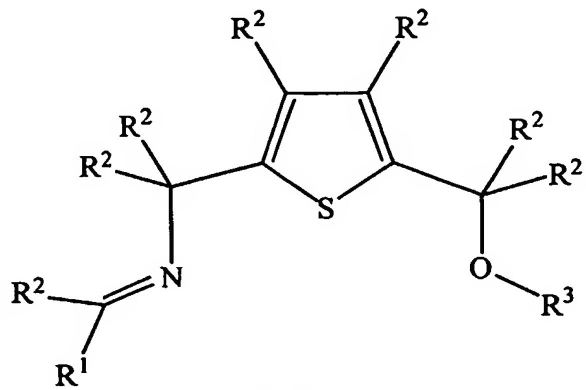
L*238



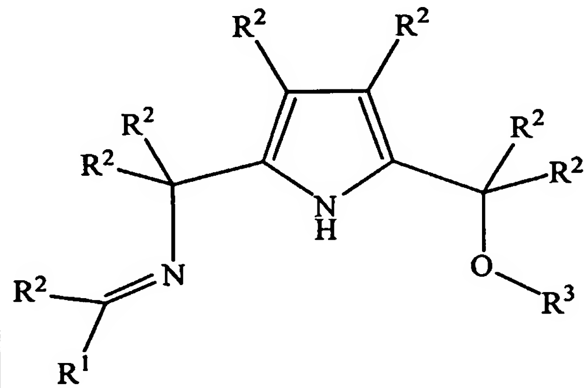
L*239



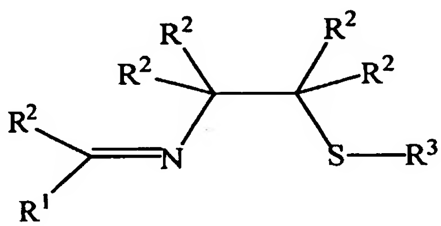
L*240



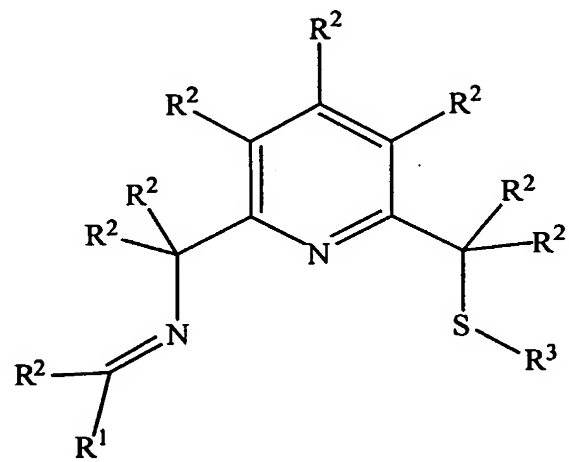
L*241



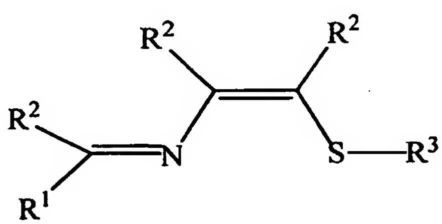
L*242



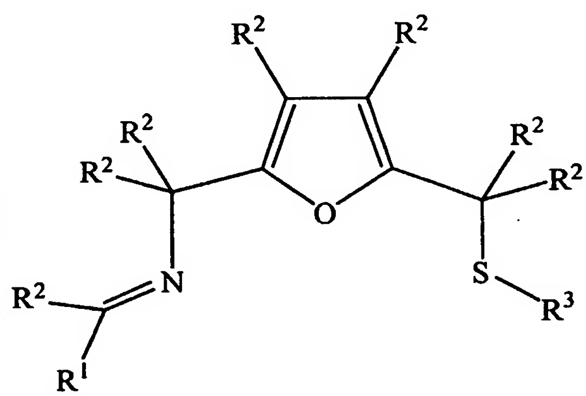
L*243



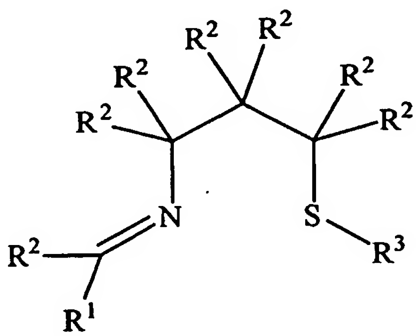
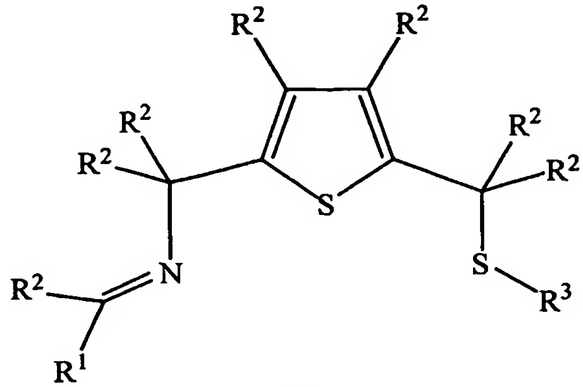
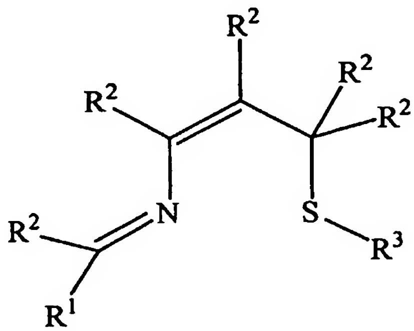
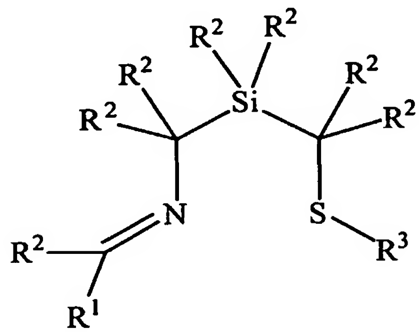
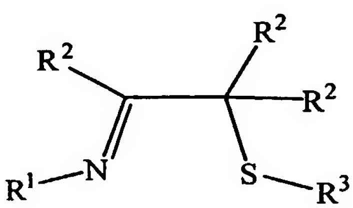
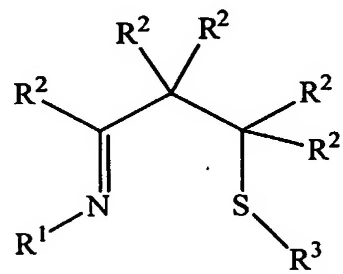
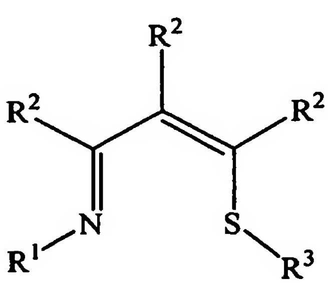
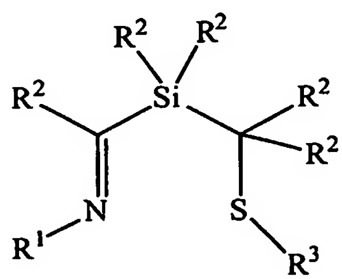
L*244

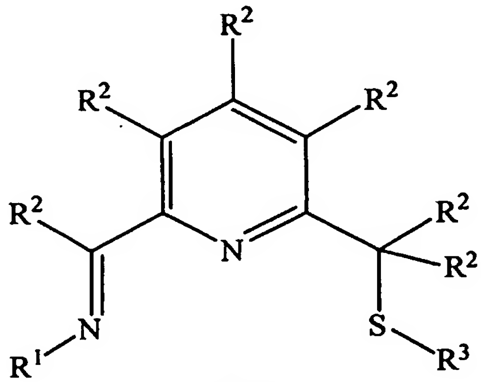
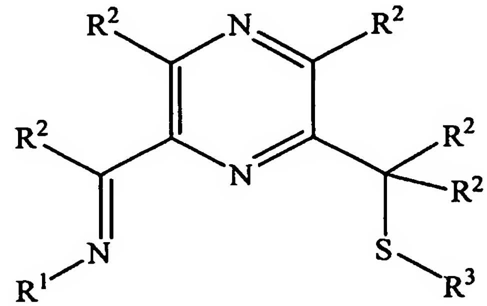
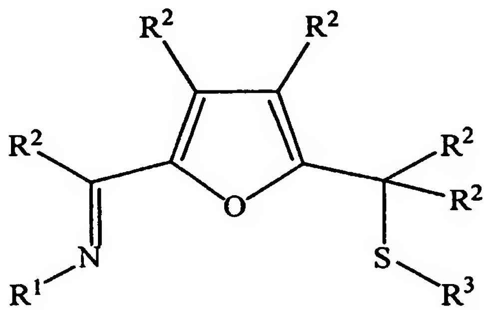
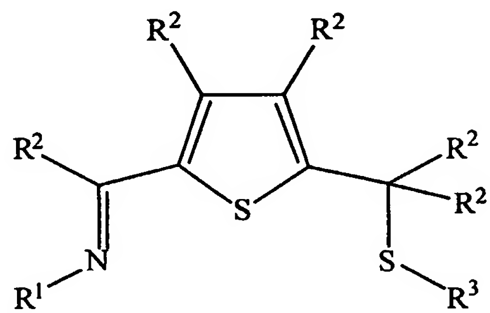
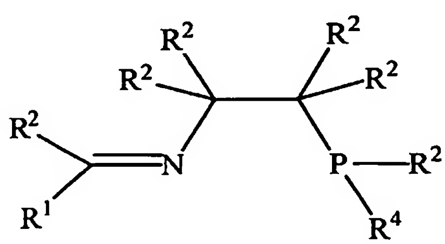
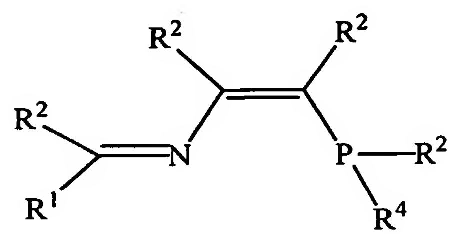


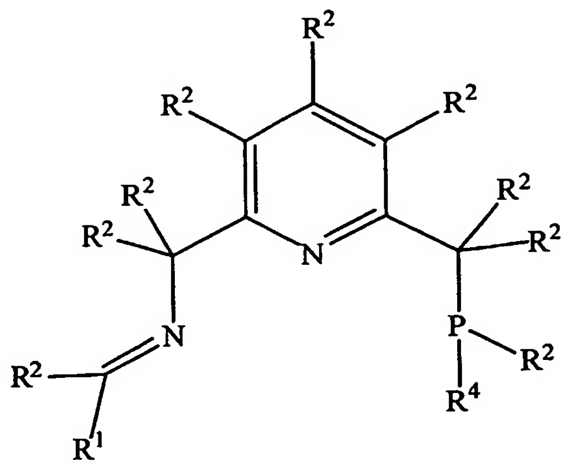
L*245



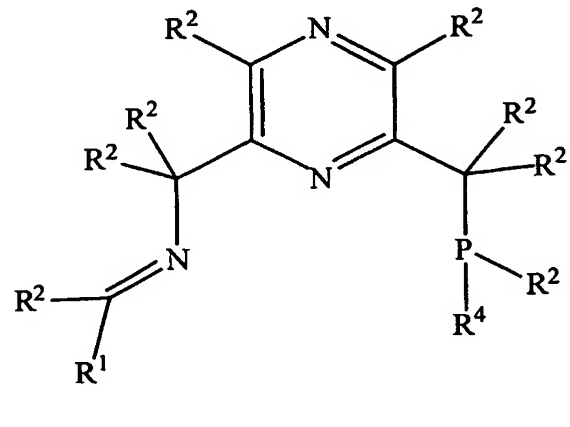
L*246

 L*247	 L*248
 L*249	 L*250
 L*251	 L*252
 L*253	 L*254

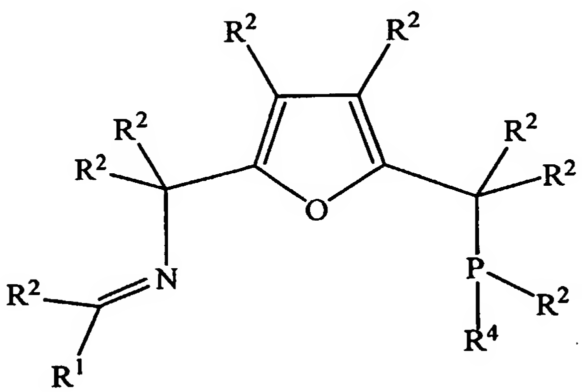
 L*255	 L*256
 L*257	 L*258
 L*259	 L*260



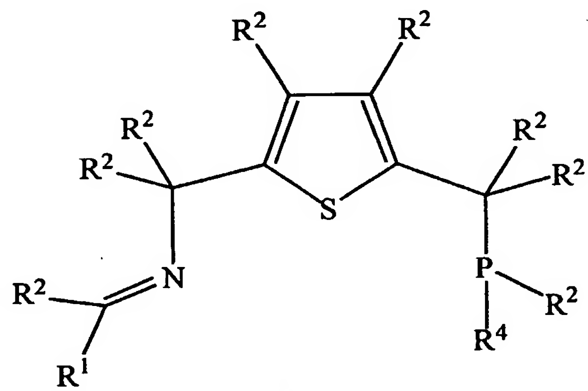
L*261



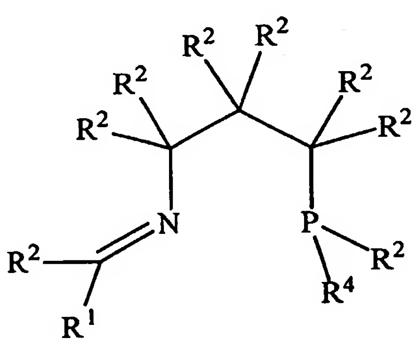
L*262



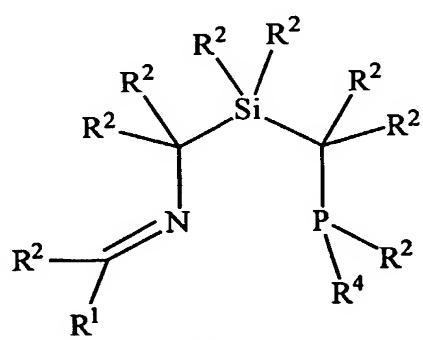
L*263



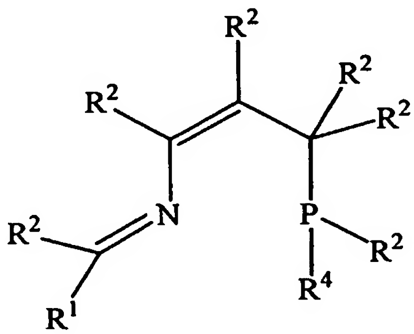
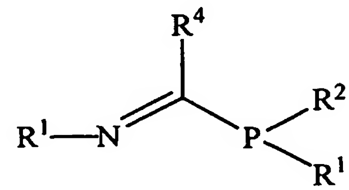
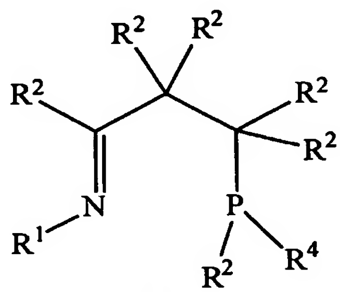
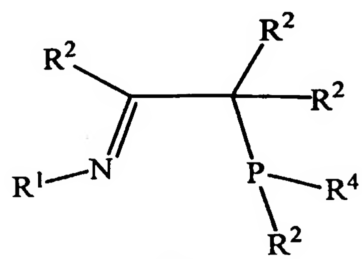
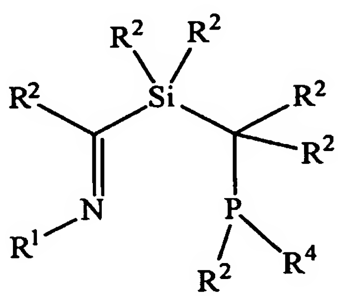
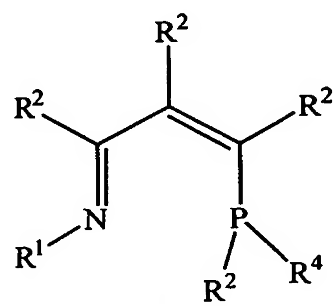
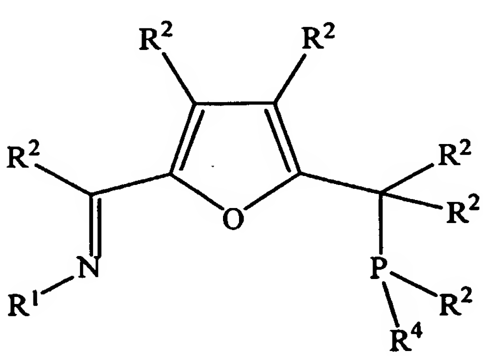
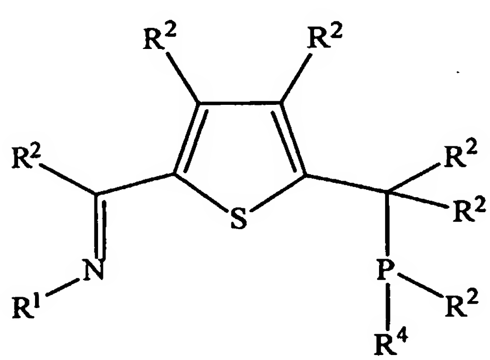
L*264

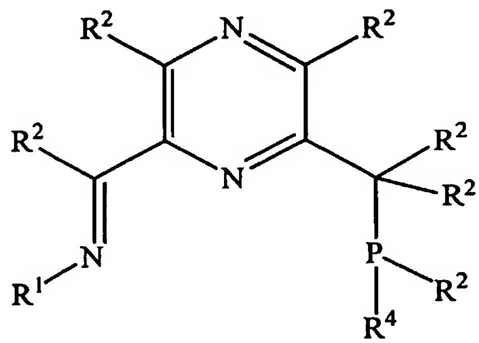
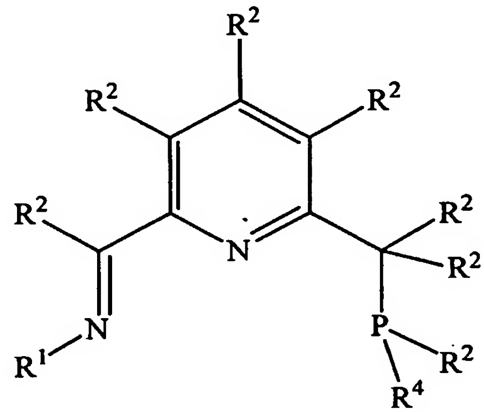
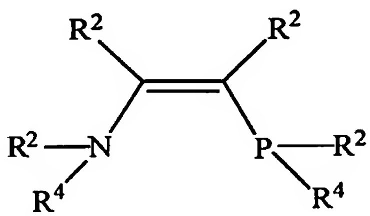
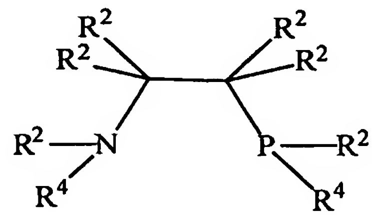
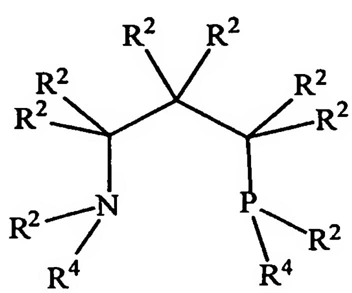
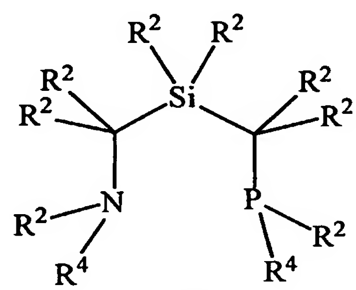


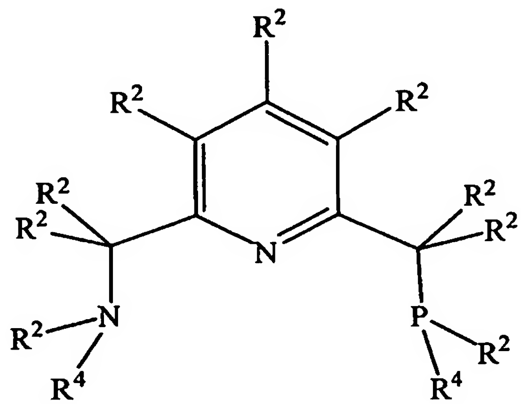
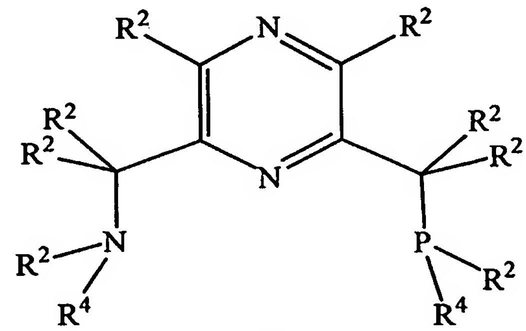
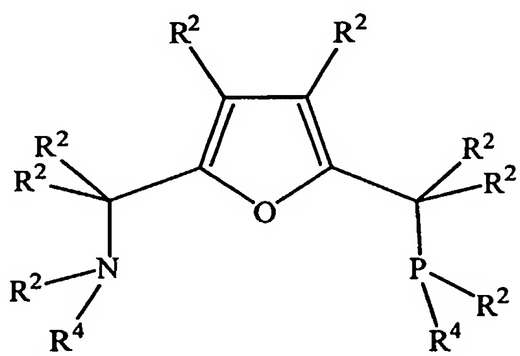
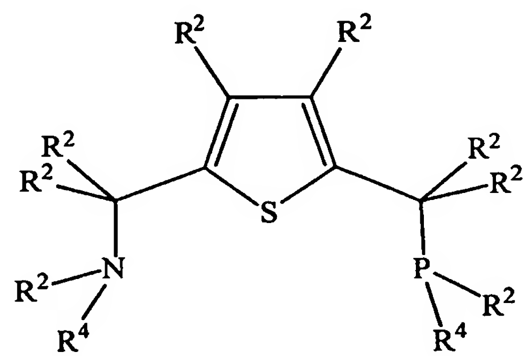
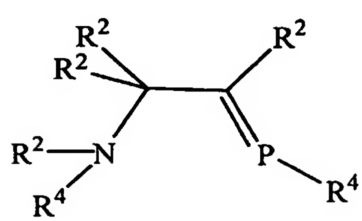
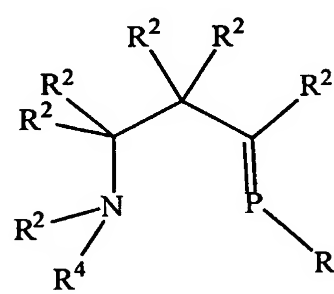
L*265

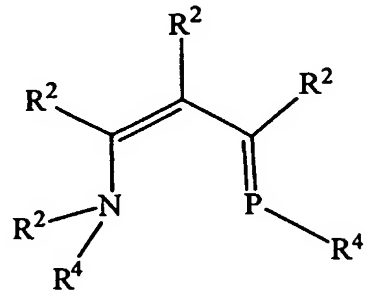
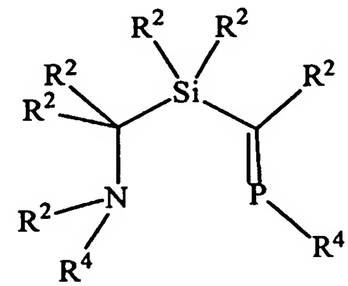
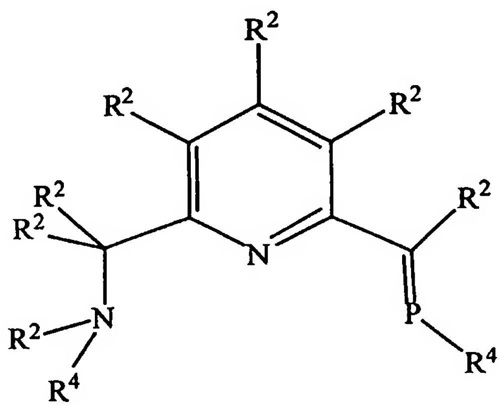
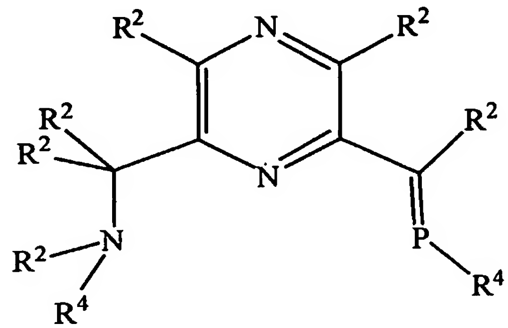
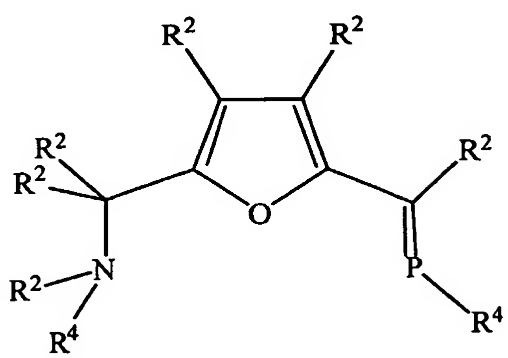
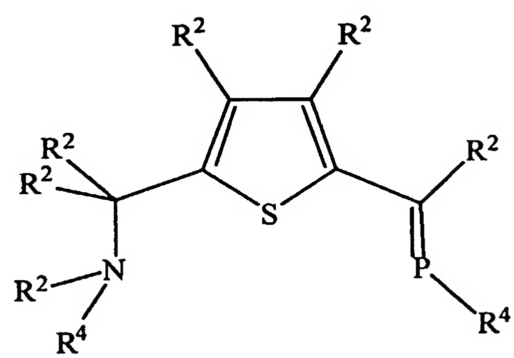
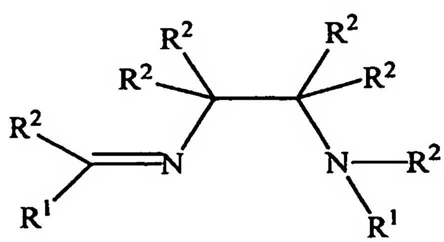
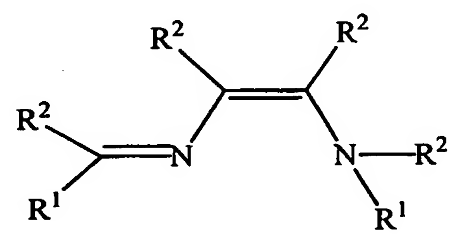


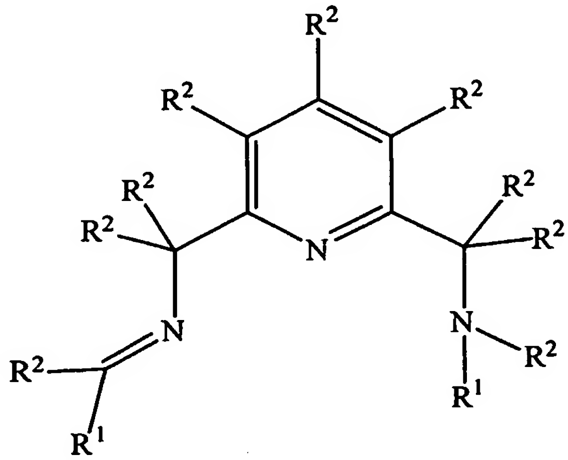
L*266

 L*267	 L*268
 L*269	 L*270
 L*271	 L*272
 L*273	 L*274

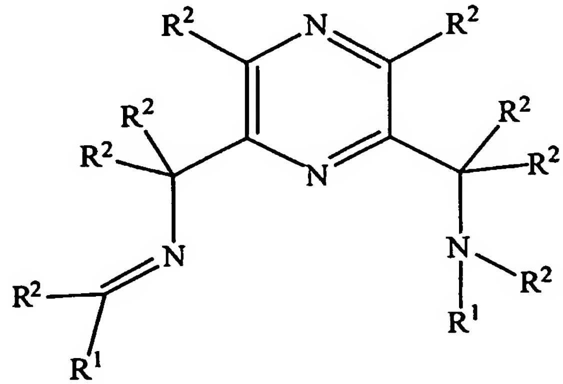
 L*275	 L*276
 L*277	 L*278
 L*279	 L*280

 L*281	 L*282
 L*283	 L*284
 L*285	 L*286

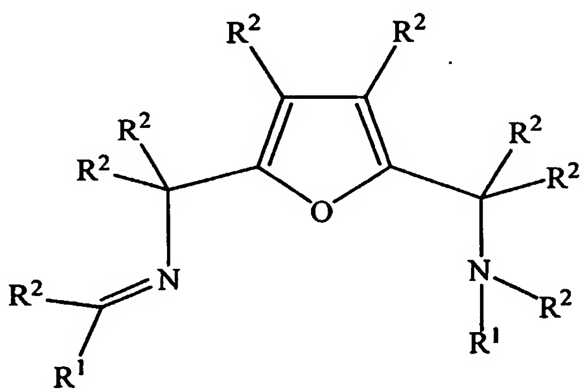
 L*287	 L*288
 L*289	 L*290
 L*291	 L*292
 L*293	 L*294



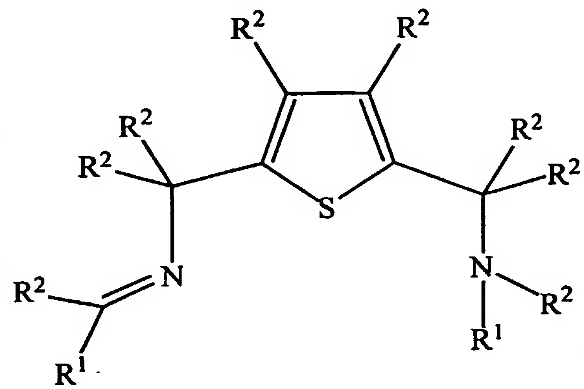
L*295



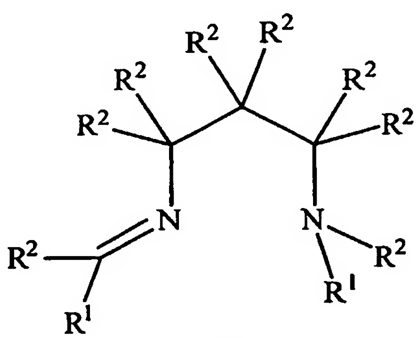
L*296



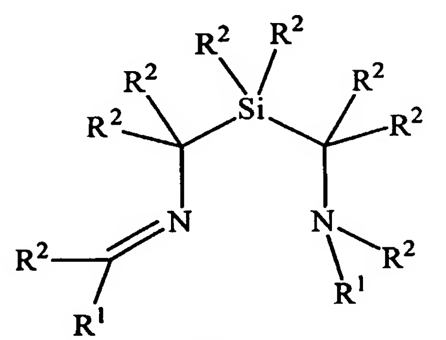
L*297



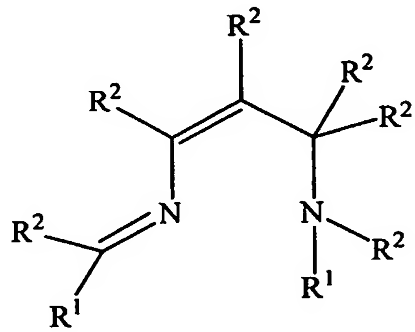
L*298



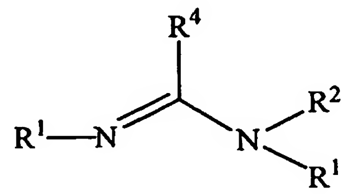
L*299



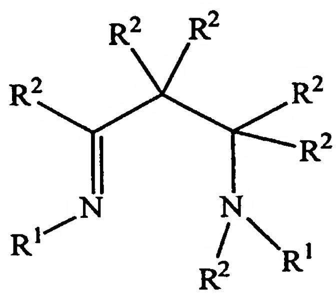
L*300



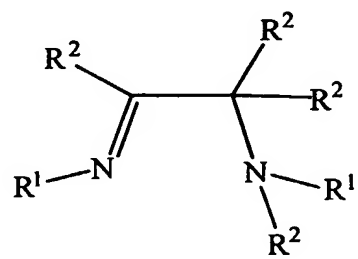
L*301



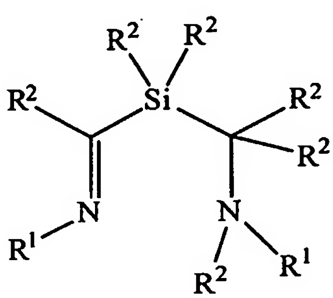
L*302



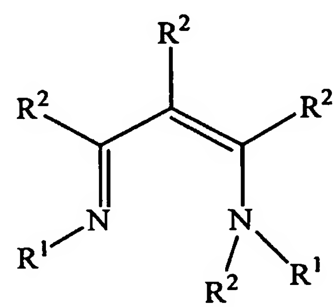
L*303



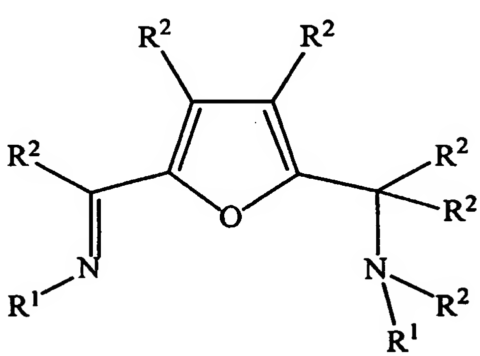
L*304



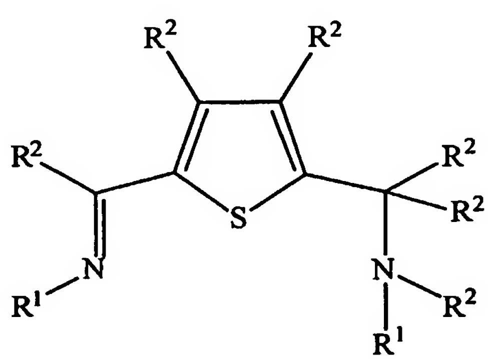
L*305



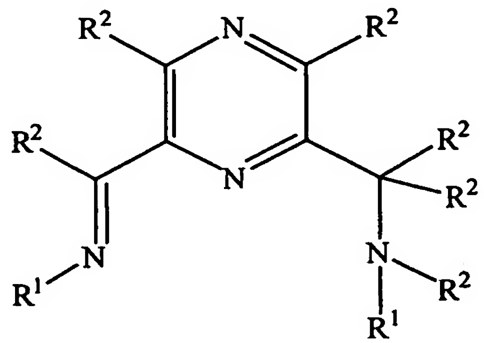
L*306



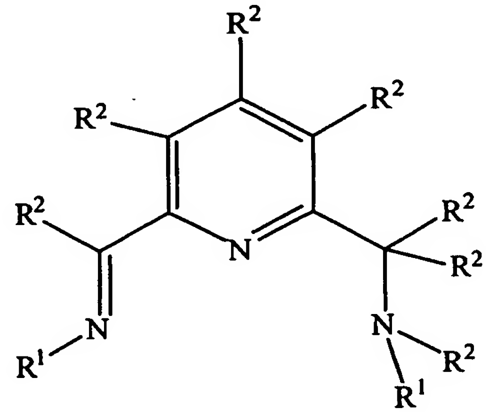
L*307



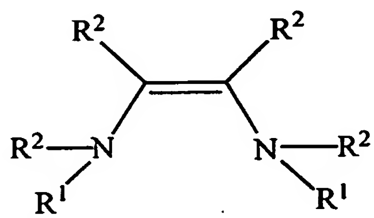
L*308



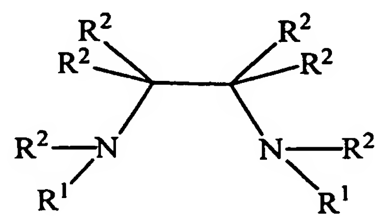
L*309



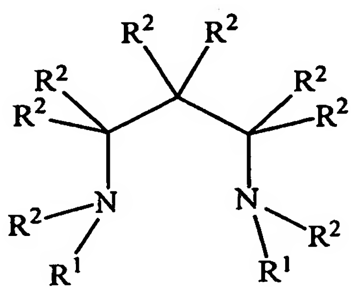
L*310



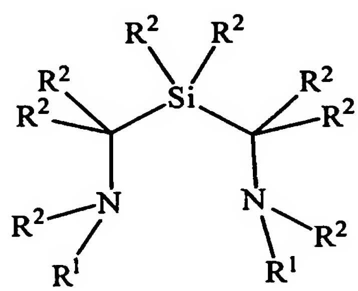
L*311



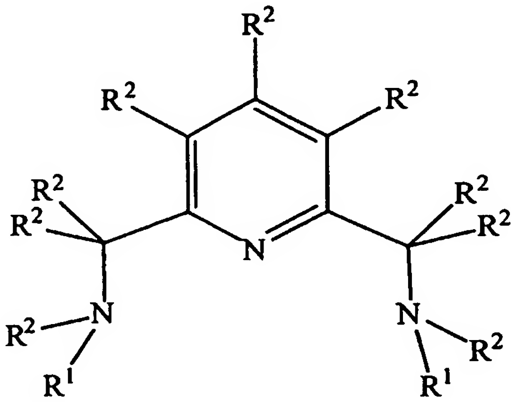
L*312



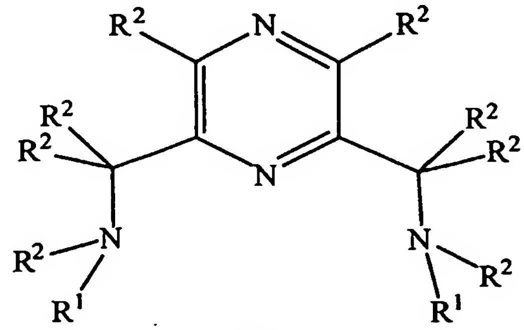
L*313



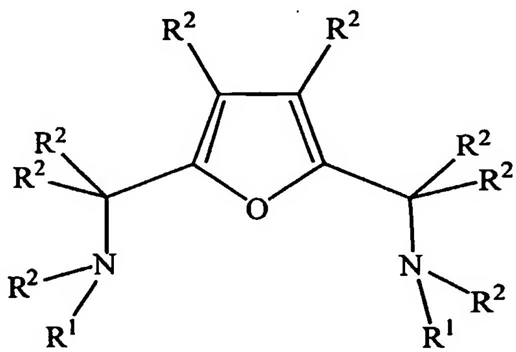
L*314



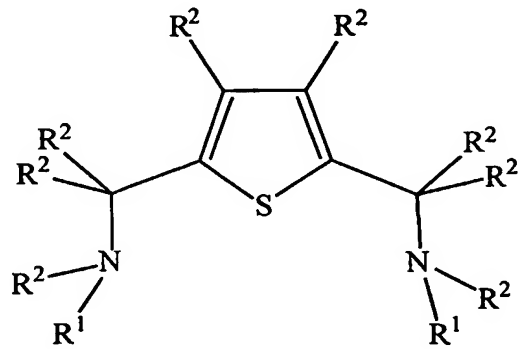
L*315



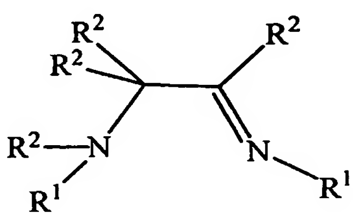
L*316



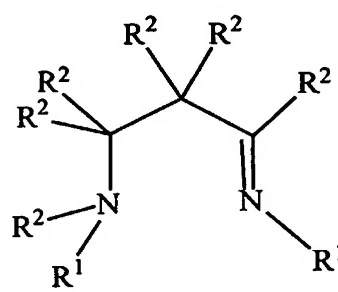
L*317



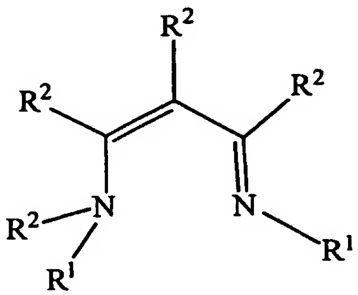
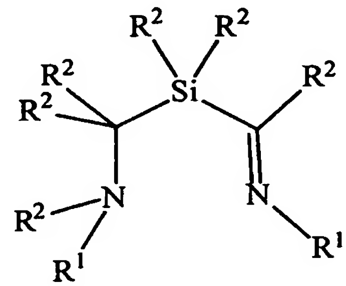
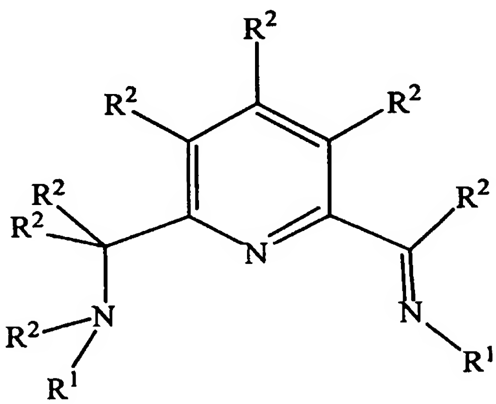
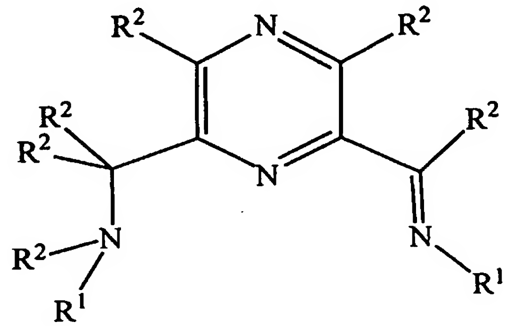
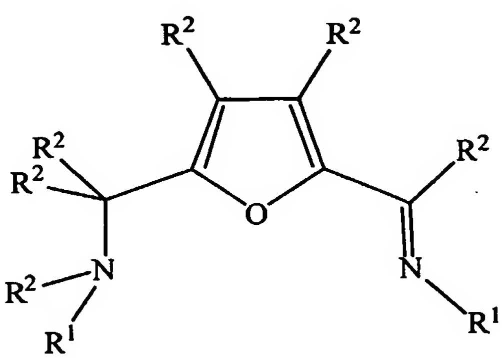
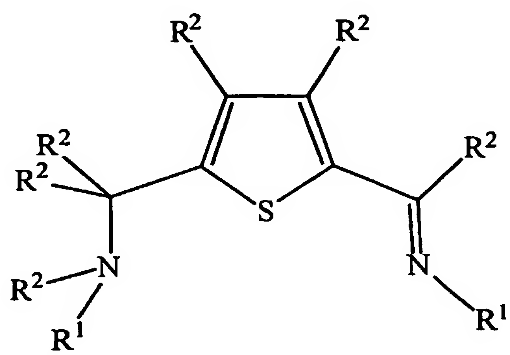
L*318

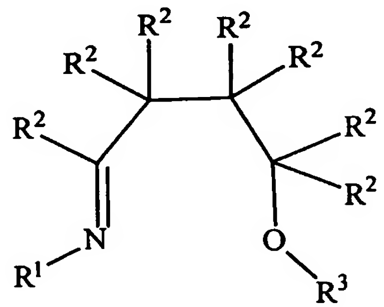
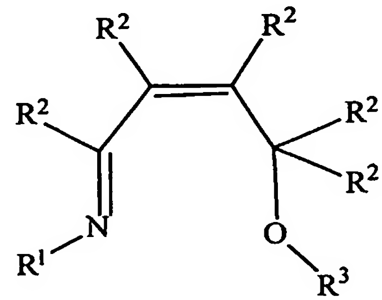
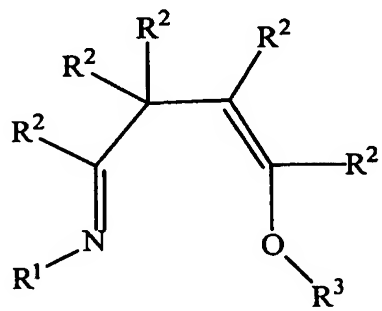
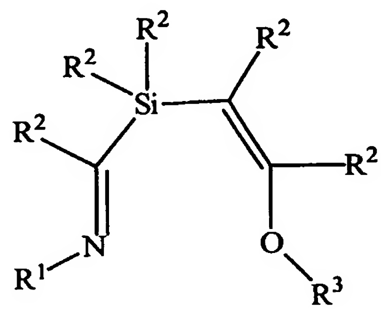
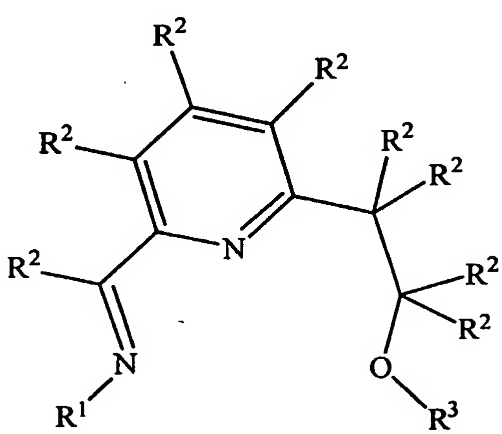
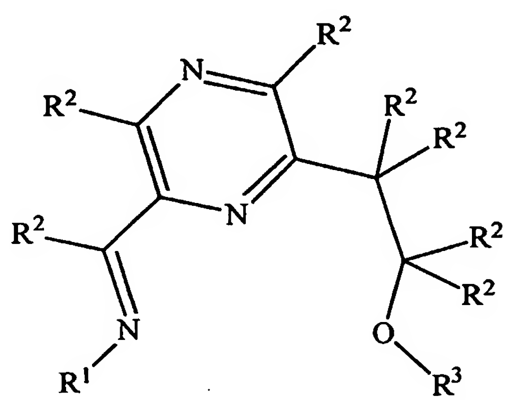


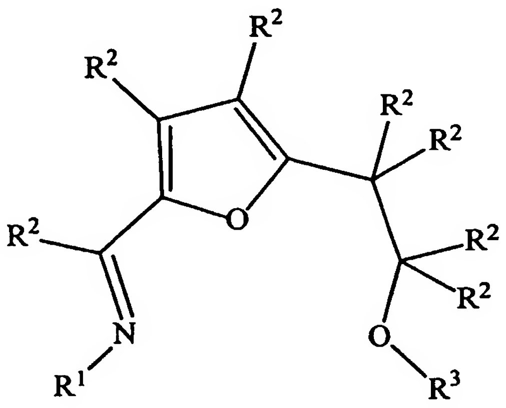
L*319



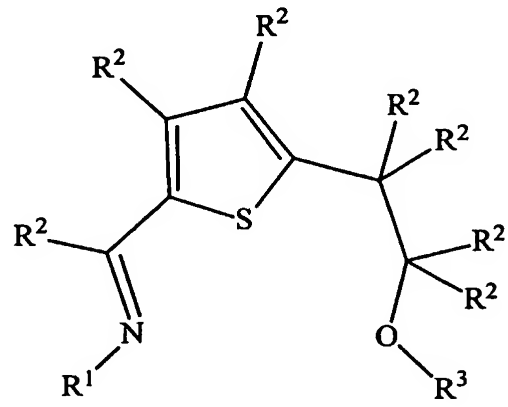
L*320

 L*321	 L*322
 L*323	 L*324
 L*325	 L*326

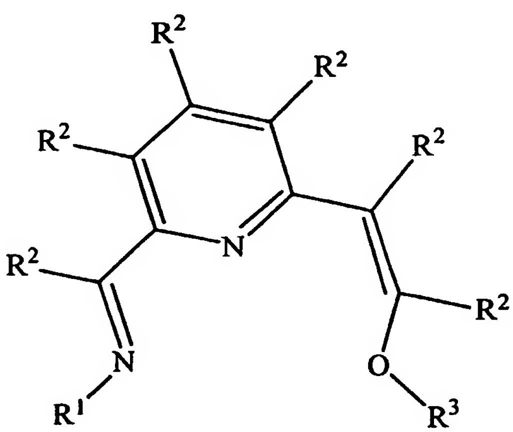
 L*327	 L*328
 L*329	 L*330
 L*331	 L*332



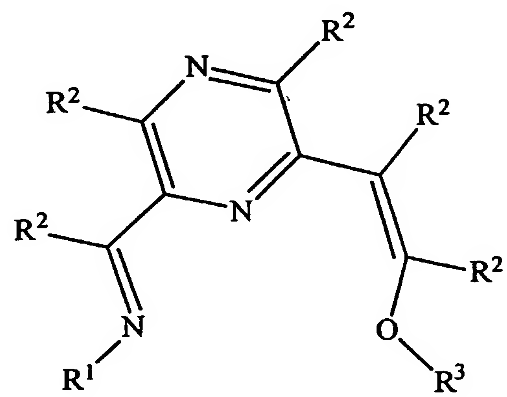
L*333



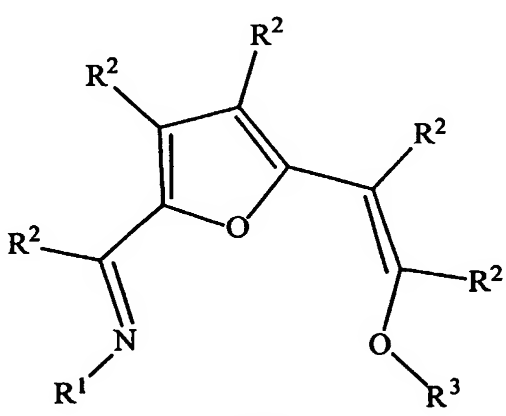
L*334



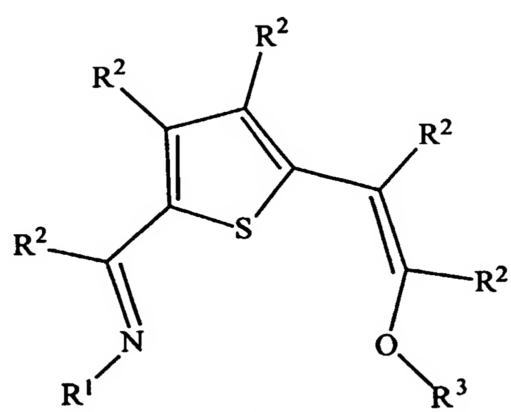
L*335



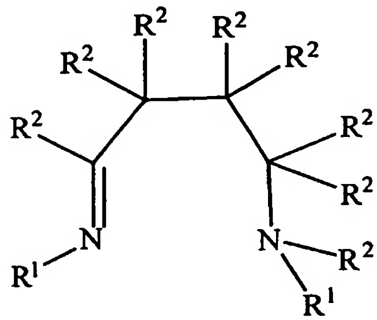
L*336



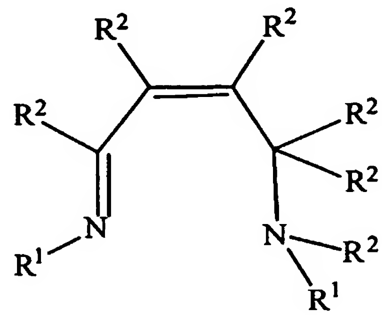
L*337



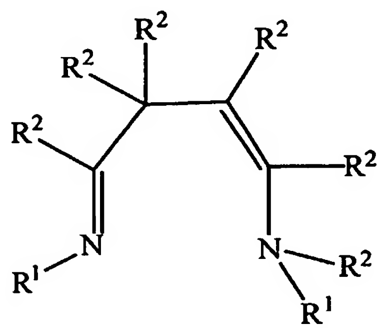
L*338



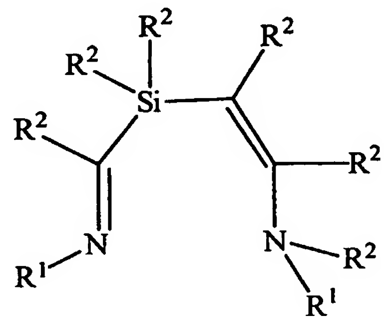
L*339



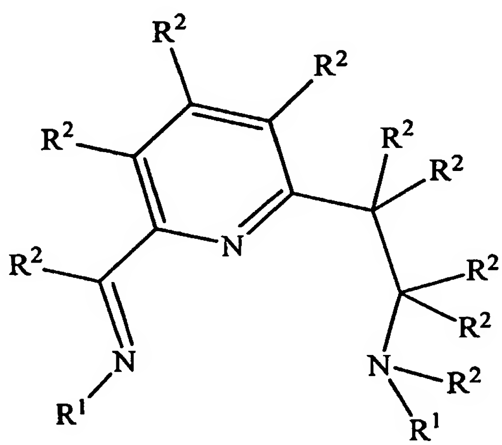
L*340



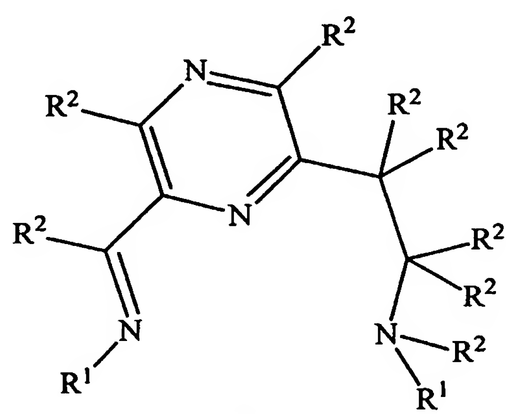
L*341



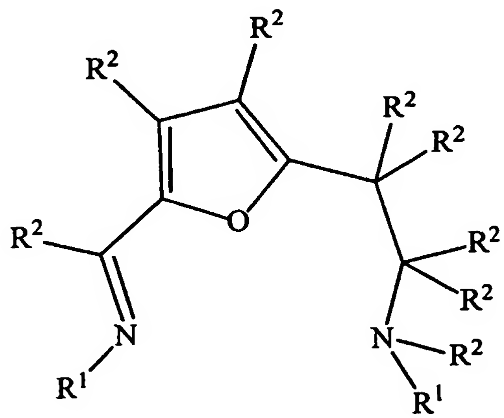
L*342



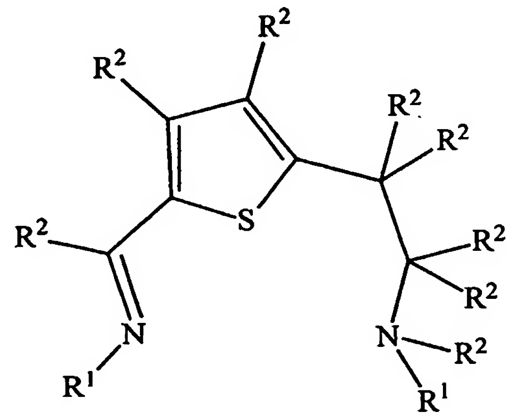
L*343



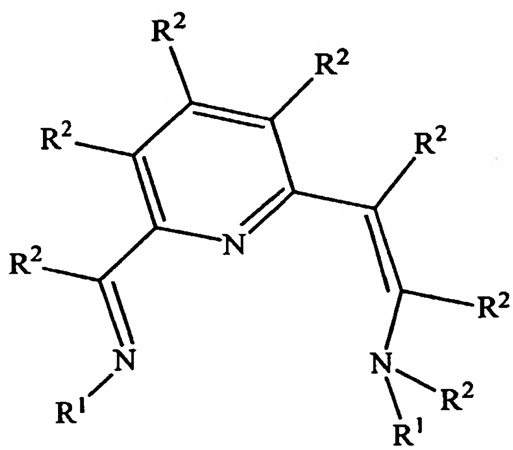
L*344



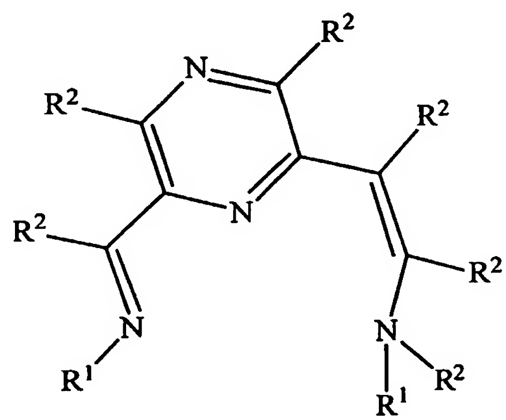
L*345



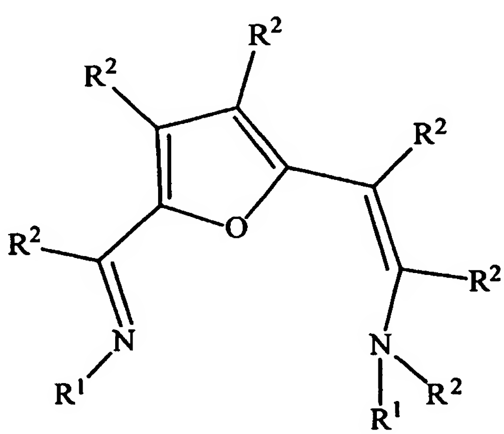
L*346



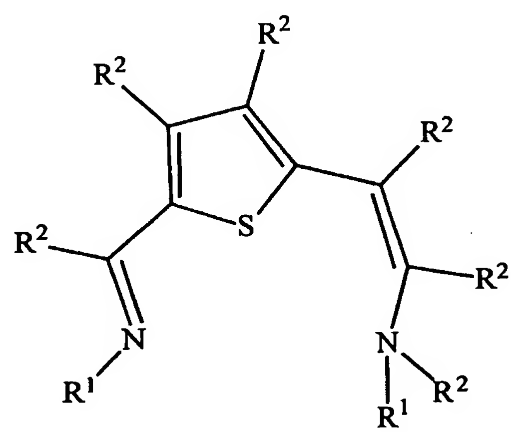
L*347



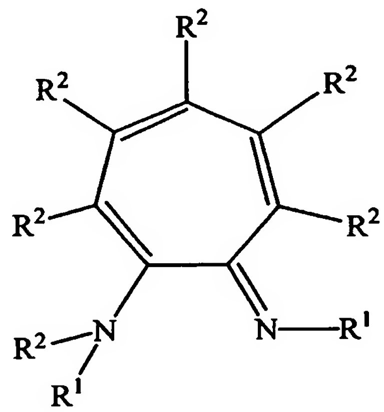
L*348



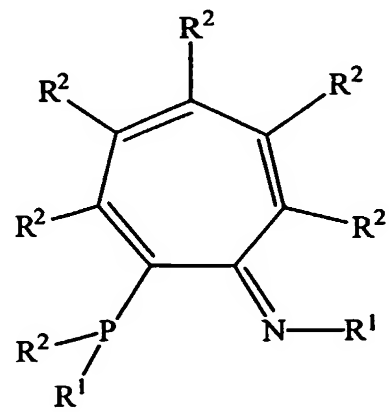
L*349



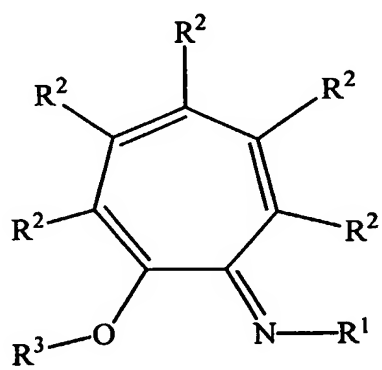
L*350



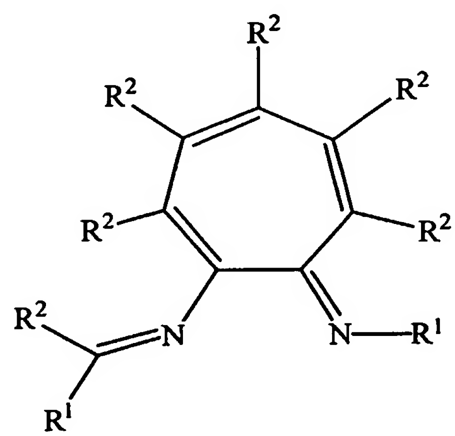
L*351



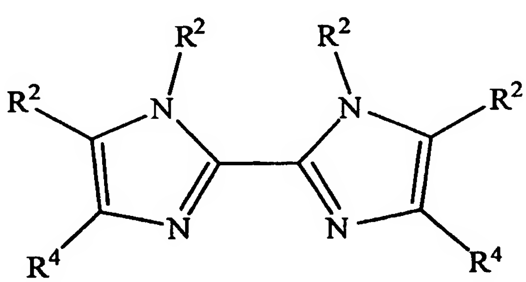
L*352



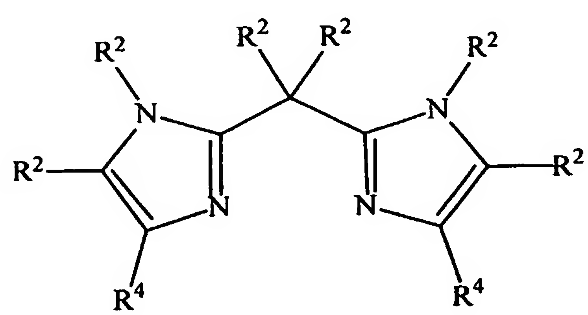
L*353



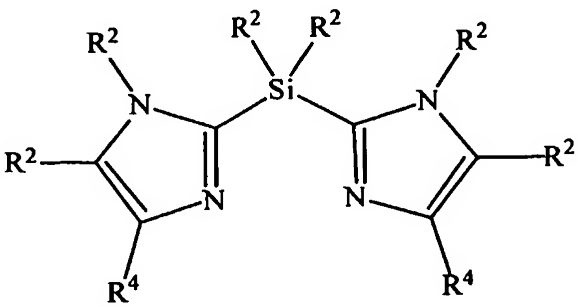
L*354



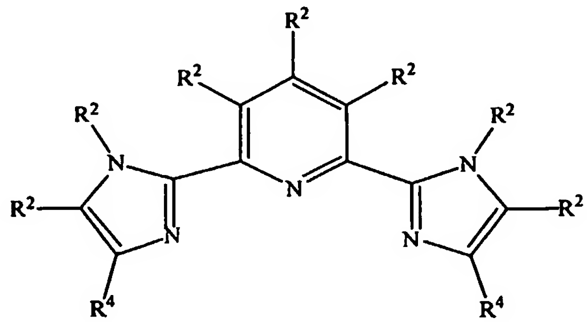
L*355



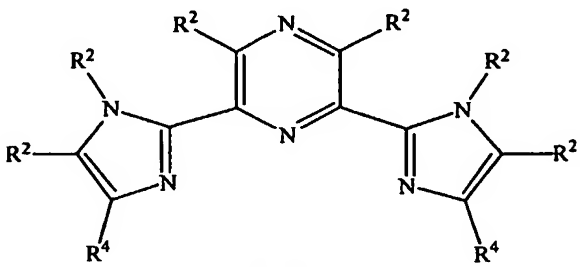
L*356



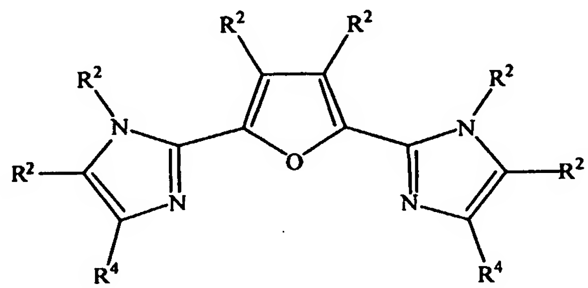
L*357



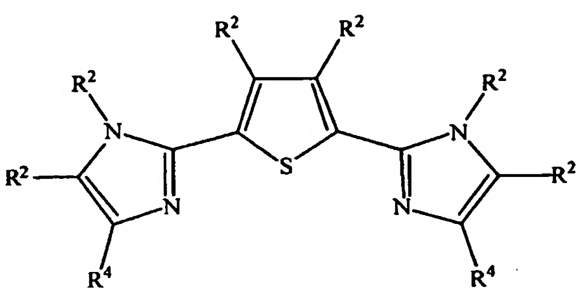
L*358



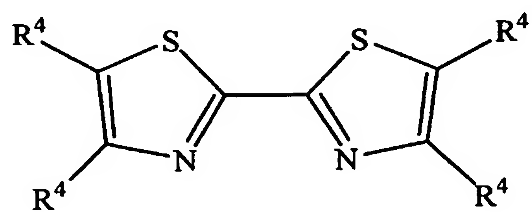
L*359



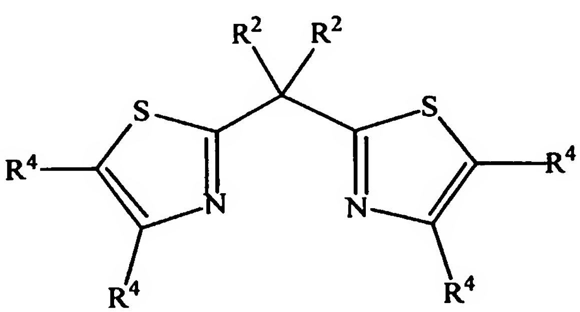
L*360



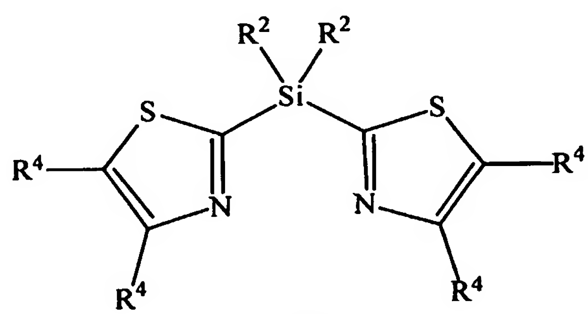
L*361



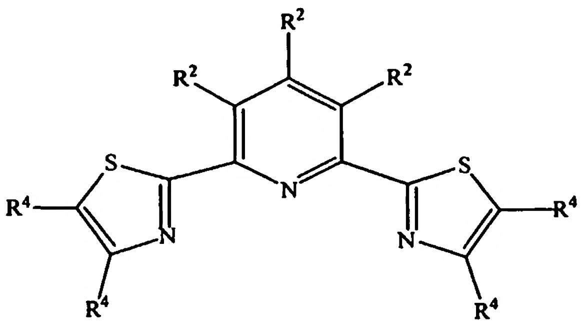
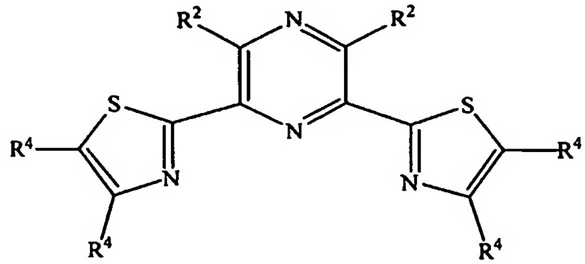
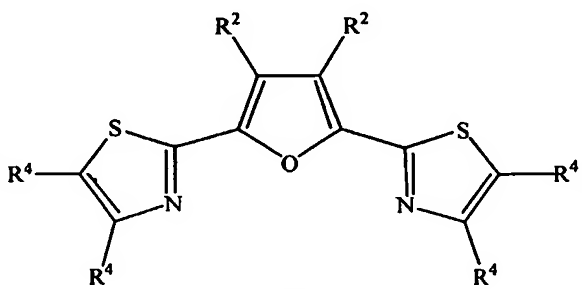
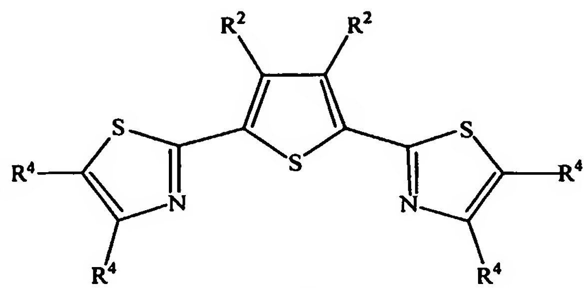
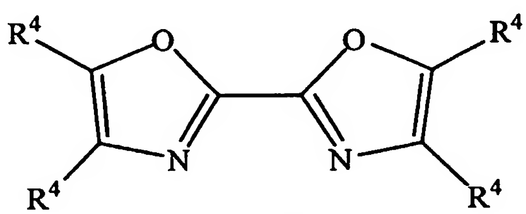
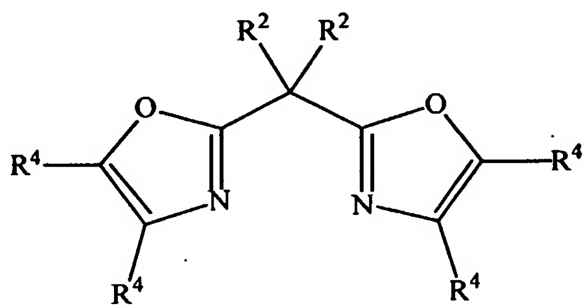
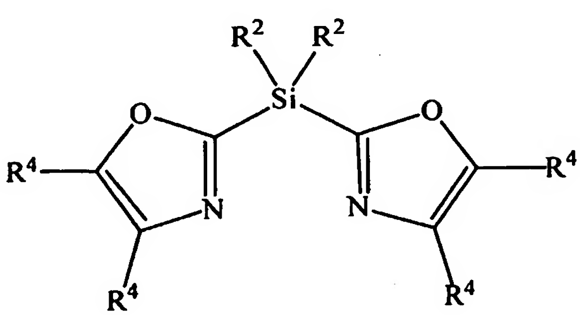
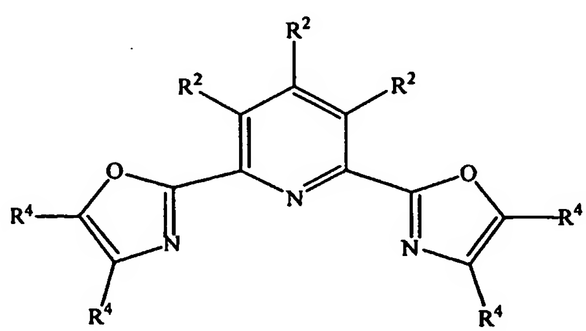
L*362

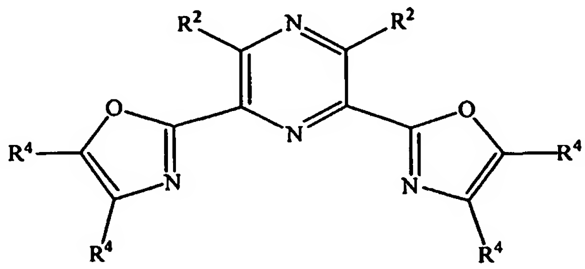
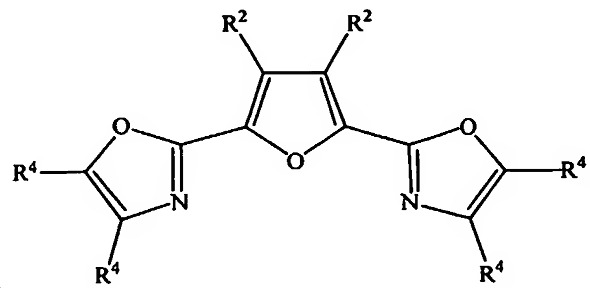
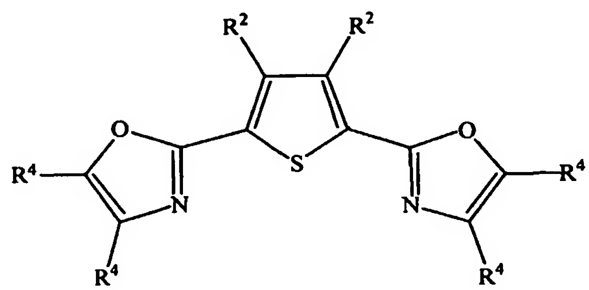
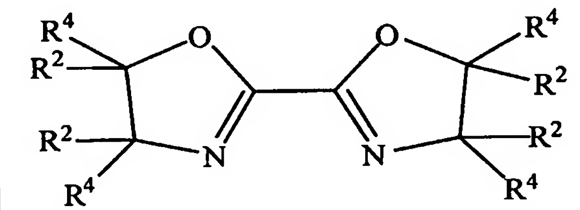
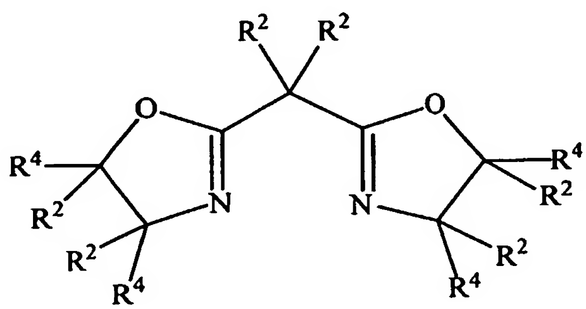
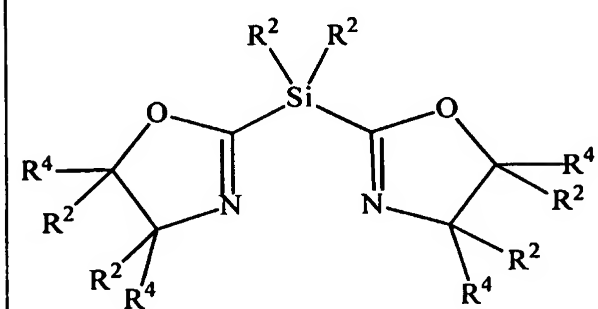
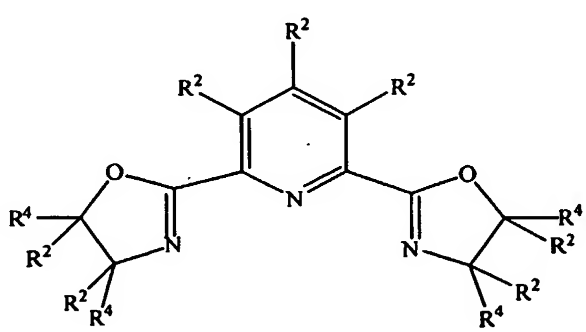
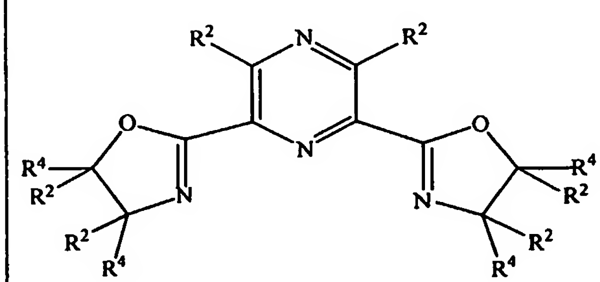


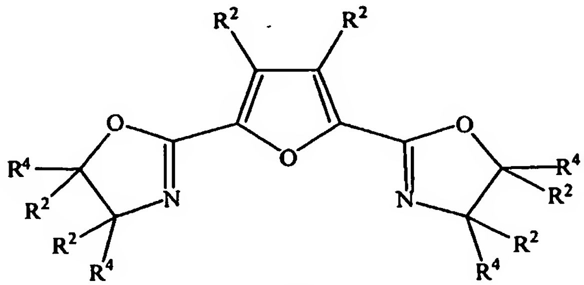
L*363



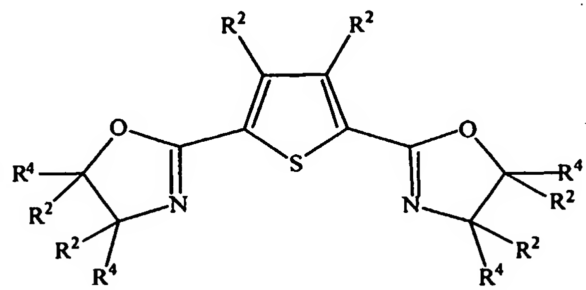
L*364

 L*365	 L*366
 L*367	 L*368
 L*369	 L*370
 L*371	 L*372

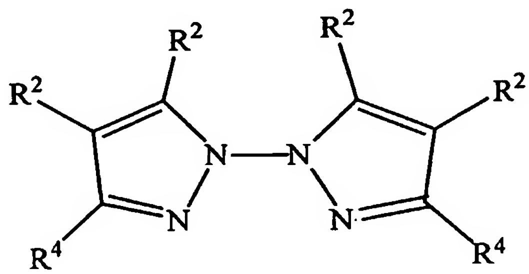
 L*373	 L*374
 L*375	 L*376
 L*377	 L*378
 L*379	 L*380



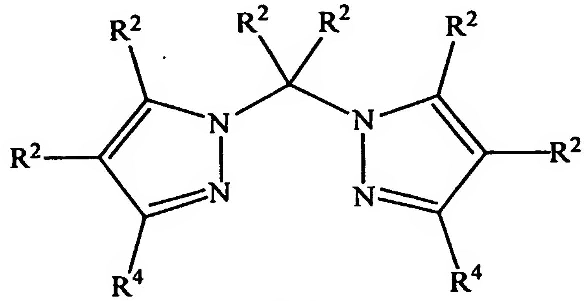
L*381



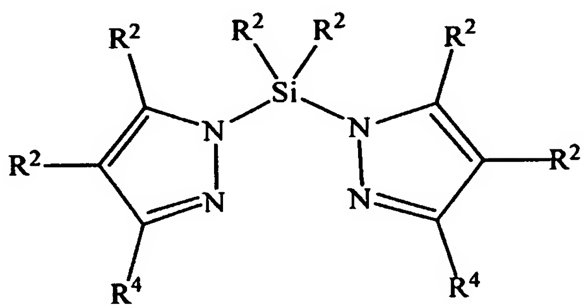
L*382



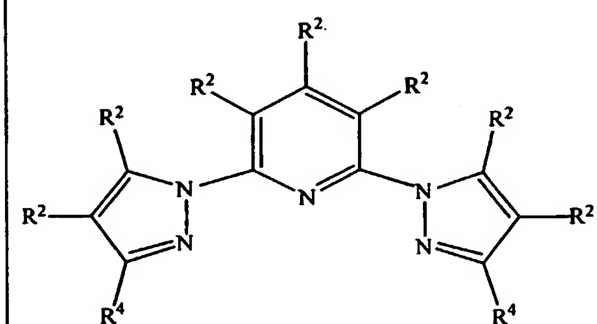
L*383



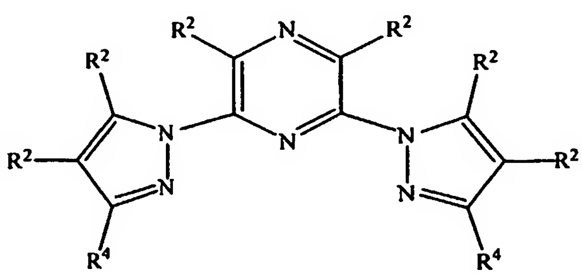
L*384



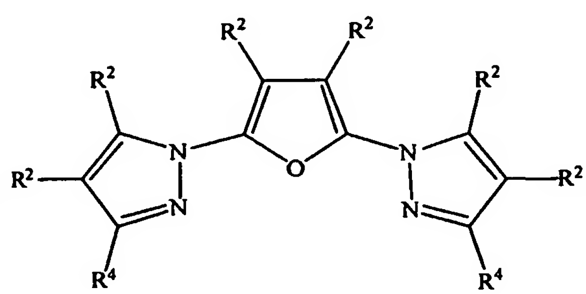
L*385



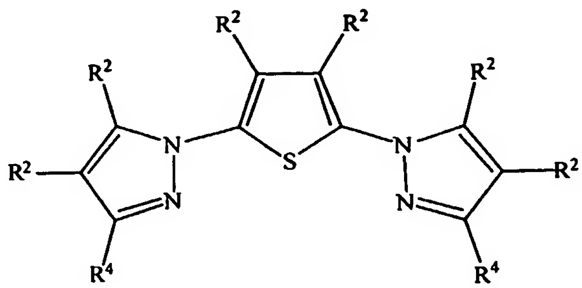
L*386



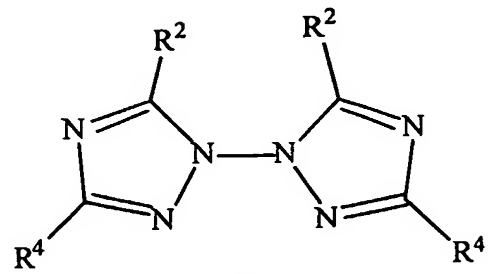
L*387



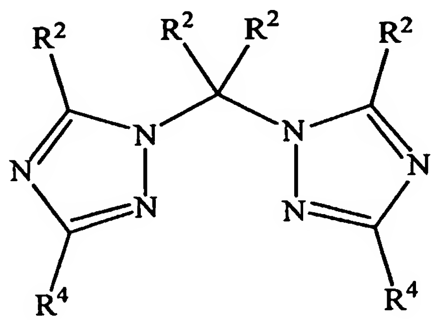
L*388



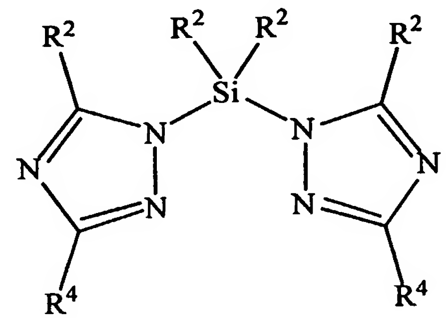
L*389



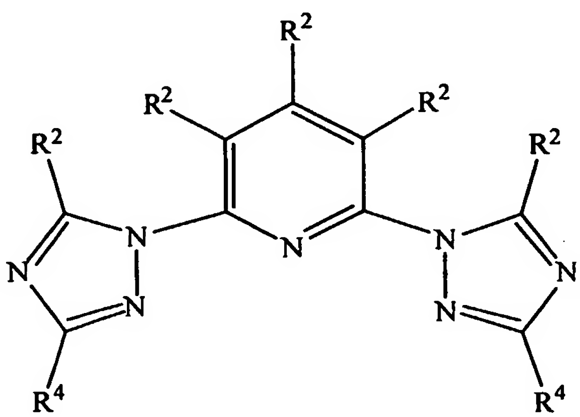
L*390



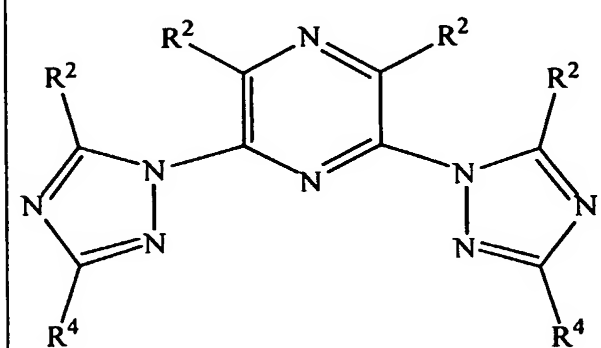
L*391



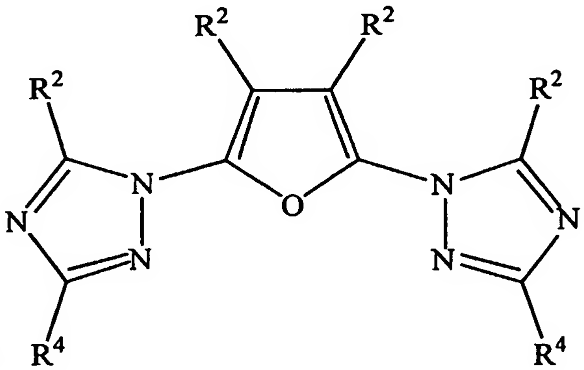
L*392



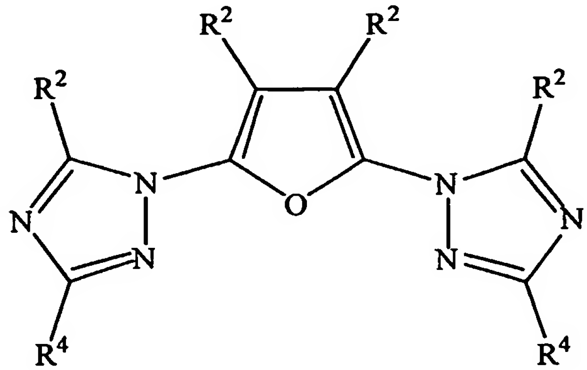
L*393



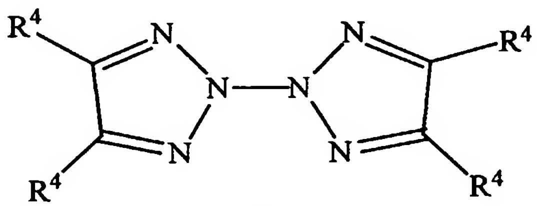
L*394



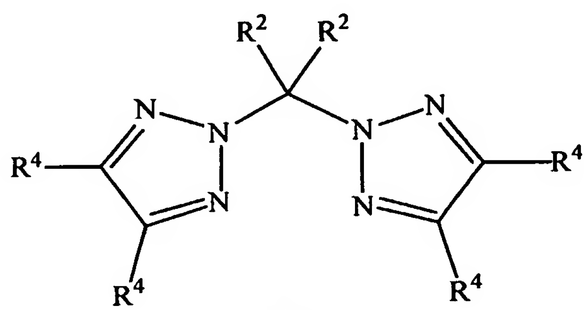
L*395



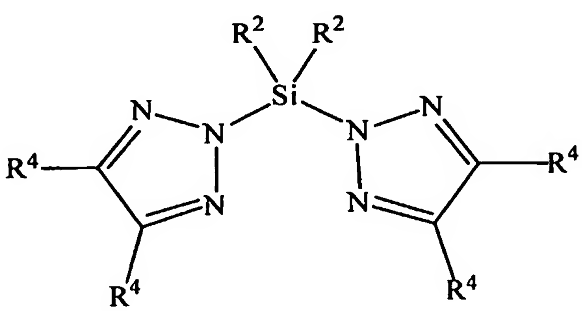
L*396



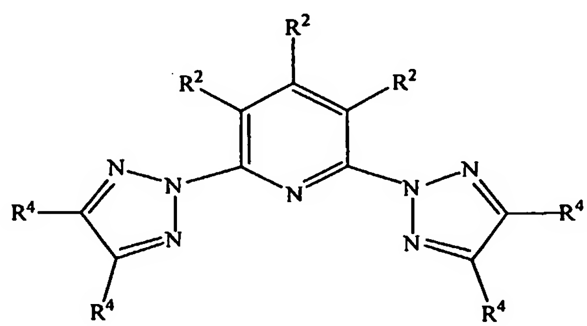
L*397



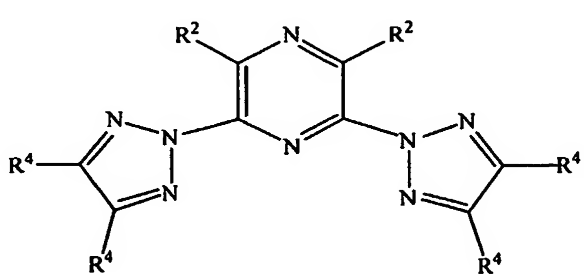
L*398



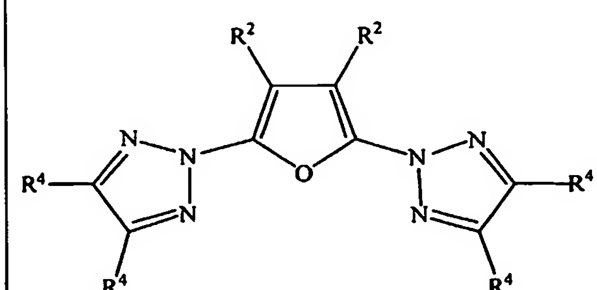
L*399



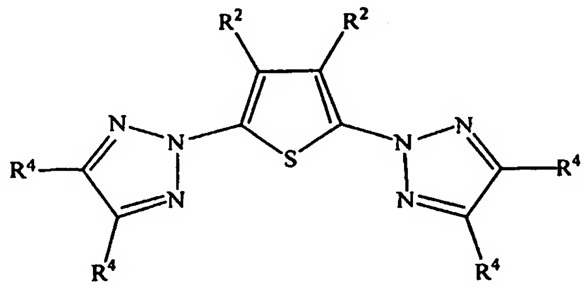
L*400



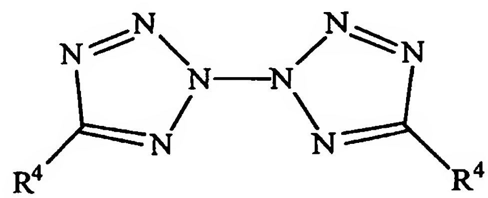
L*401



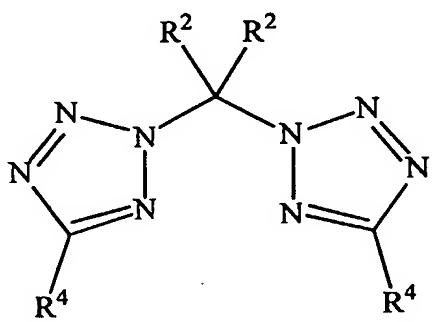
L*402



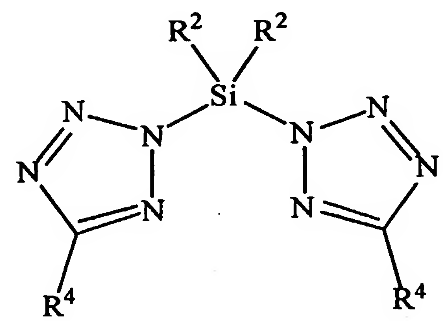
L*403



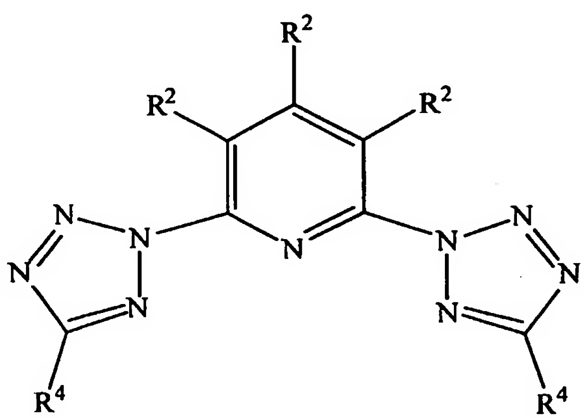
L*404



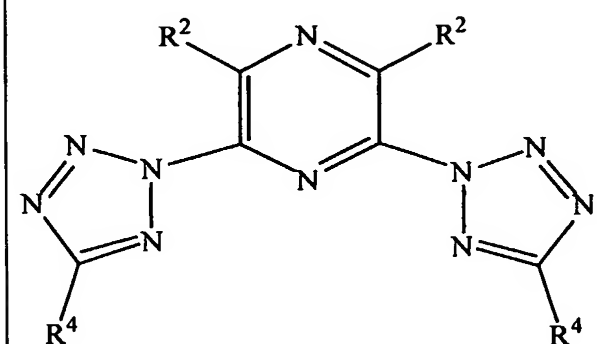
L*405



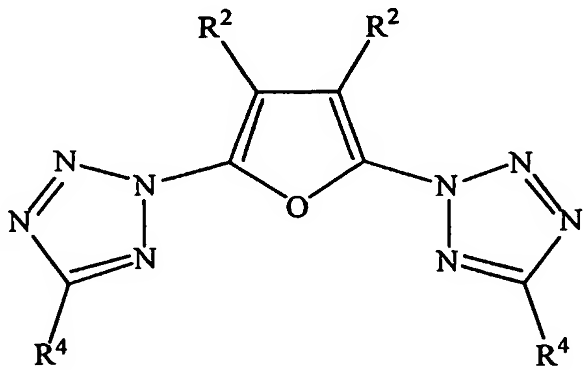
L*406



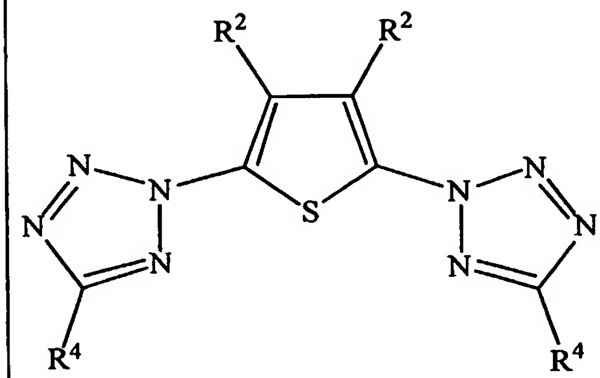
L*407



L*408



L*409

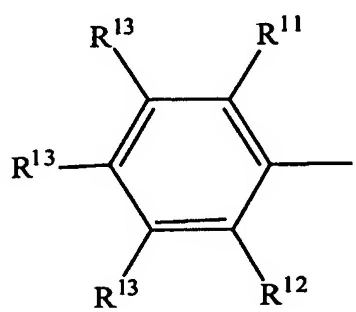
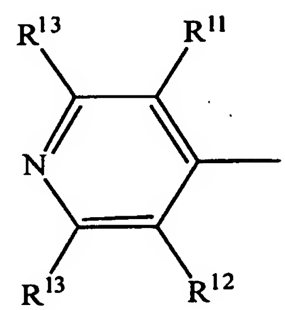
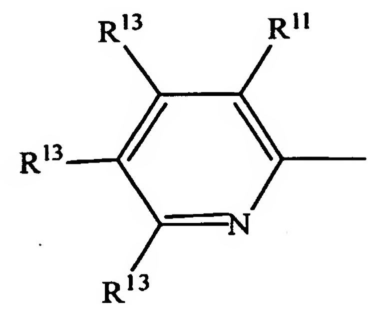
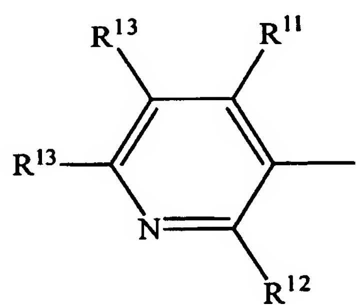
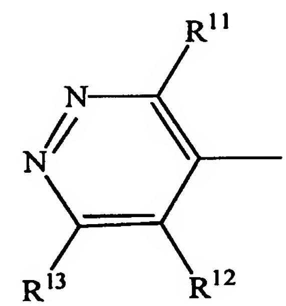
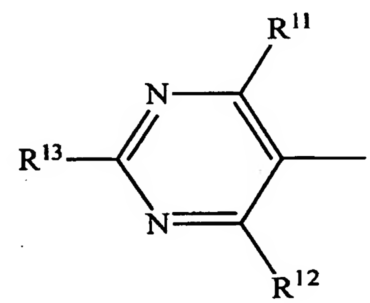
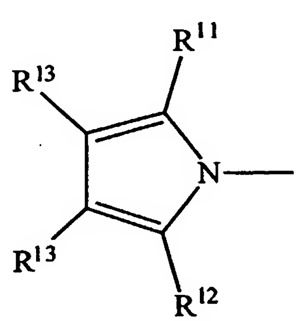
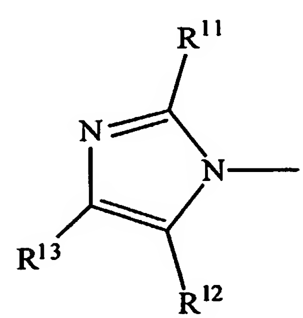
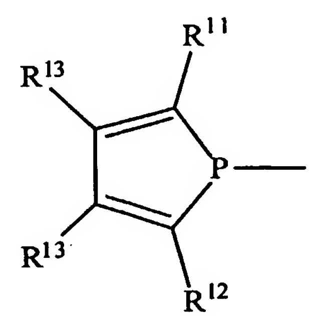


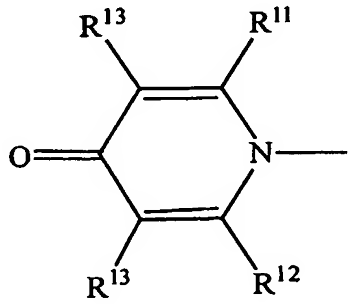
L*410

where R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. –$OSiMe_3$); R^3 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl, or R^3 is a substituted hydrocarbyl group containing a heteroatom or silicon atom directly bonded to the indicated O or S atom; R^4 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl, preferably R^4 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl. R^1, R^2, R^3 and/or R^4 groups on the same atom, adjacent atoms or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure provided that for L*1, both pair of R^1 and R^2 do not join to form a substituted or unsubstituted pyridine, pyrazine, pyrimidine or benzimidazole ring; and two R^2 bonded to the same atom together may form an –one (=O), a thione (=S), an –imine (=NR'''), or a –carbene (=CR'''$_2$) group where R''' is, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl and two or more R''' on the same carbon may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent. For purposes of the claims to this invention when the phrase "where L is represented by the formulae L*1 to

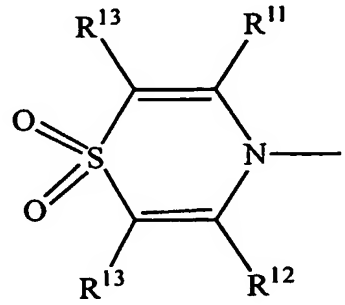
L*410" is used it is defined to mean the drawings of the formulae in the above table but not the definitions of the symbols in this paragraph.

Non-limiting examples of preferred bulky hydrocarbyl groups useful as R^1, include substituents represented by the following structures:

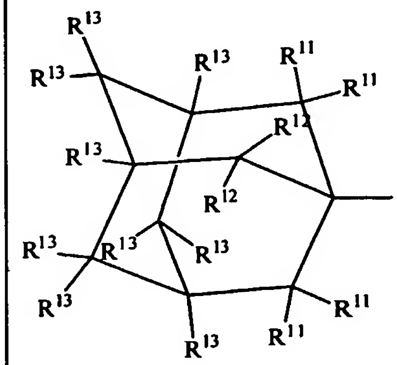
 S1	 S2	 S3
 S4	 S5	 S6
 S7	 S8	 S9



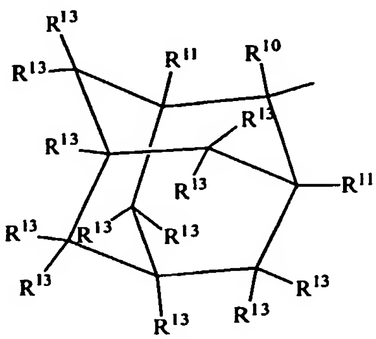
S10



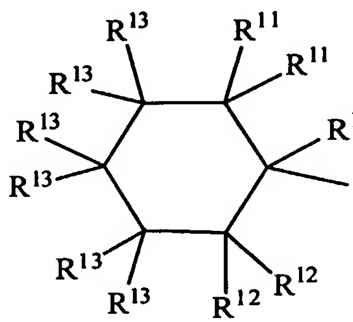
S11



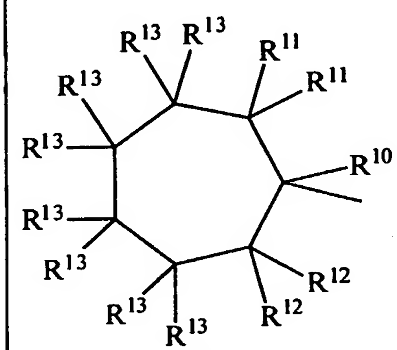
S12



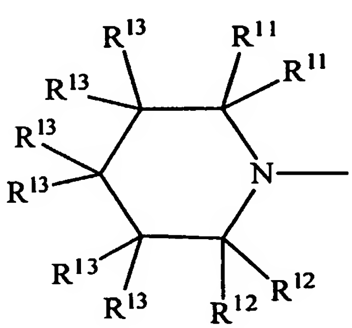
S13



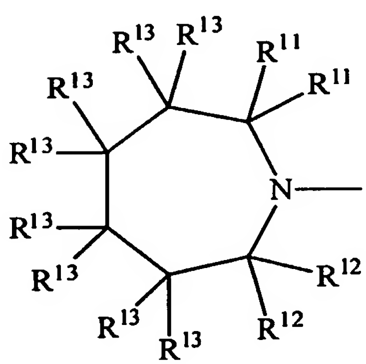
S14



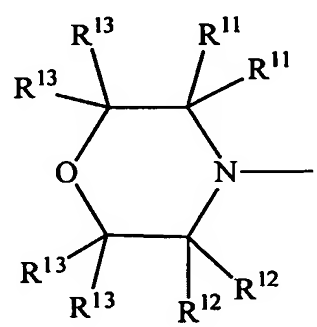
S15



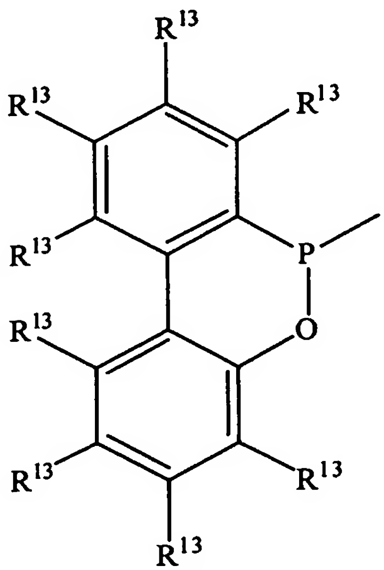
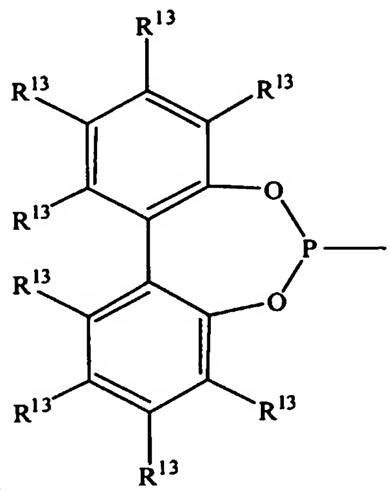
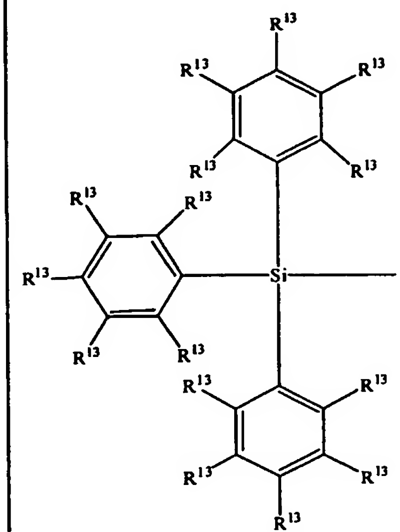
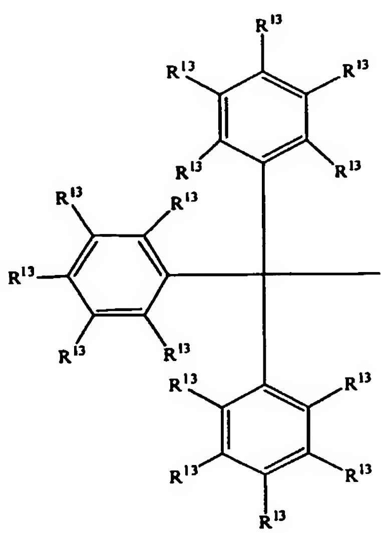
S16



S17



S18

 S19	 S29	 S30
 S31		

where R^{10}, R^{11}, R^{12}, and R^{13} are, independently, hydrogen, hydrocarbyl radicals, substituted hydrocarbyl radicals, halocarbyl radicals, substituted halocarbyl radicals, silylcarbyl radicals or polar radicals. Some invention embodiments select R^{10}, R^{11}, R^{12}, and R^{13} from hydrogen or hydrocarbyl radicals including methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl,

heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl; from halocarbyls and all isomers of halocarbyls including perfluoropropyl, perfluorobutyl, perfluoropentyl, perfluorohexyl, perfluoroheptyl, perfluorooctyl, perfluorononyl, perfluorodecyl, perfluoroundecyl, perfluorododecyl, perfluorotridecyl, perfluorotetradecyl, perfluoropentadecyl, perfluorohexadecyl, perfluoroheptadecyl, perfluorooctadecyl, perfluorononadecyl, perfluoroeicosyl, perfluoroheneicosyl, perfluorodocosyl, perfluorotricosyl, perfluorotetracosyl, perfluoropentacosyl, perfluorohexacosyl, perfluoroheptacosyl, perfluorooctacosyl, perfluorononacosyl, perfluorotriacontyl, perfluorobutenyl, perfluorobutynyl, fluoropropyl, fluorobutyl, fluoropentyl, fluorohexyl, fluoroheptyl, fluorooctyl, fluorononyl, fluorodecyl, fluoroundecyl, fluorododecyl, fluorotridecyl, fluorotetradecyl, fluoropentadecyl, fluorohexadecyl, fluoroheptadecyl, fluorooctadecyl, fluorononadecyl, fluoroeicosyl, fluoroheneicosyl, fluorodocosyl, fluorotricosyl, fluorotetracosyl, fluoropentacosyl, fluorohexacosyl, fluoroheptacosyl, fluorooctacosyl, fluorononacosyl, fluorotriacontyl, difluorobutyl, trifluorobutyl, tetrafluorobutyl, pentafluorobutyl, hexafluorobutyl, heptafluorobutyl, octafluorobutyl; from substituted hydrocarbyl radicals and all isomers of substituted hydrocarbyl radicals including methoxypropyl, methoxybutyl, methoxypentyl, methoxyhexyl, methoxyheptyl, methoxyoctyl, methoxynonyl, methoxydecyl, methoxyundecyl, methoxydodecyl, methoxytridecyl, methoxytetradecyl, methoxypentadecyl, methoxyhexadecyl, methoxyheptadecyl, methoxyoctadecyl, methoxynonadecyl, methoxyeicosyl, methoxyheneicosyl, methoxydocosyl, methoxytricosyl, methoxytetracosyl, methoxypentacosyl, methoxyhexacosyl, methoxyheptacosyl, methoxyoctacosyl, methoxynonacosyl, methoxytriacontyl, butoxypropyl, butoxybutyl, butoxypentyl, butoxyhexyl, butoxyheptyl, butoxyoctyl, butoxynonyl, butoxydecyl, butoxyundecyl, butoxydodecyl, butoxytridecyl, butoxytetradecyl, butoxypentadecyl,

butoxyhexadecyl, butoxyheptadecyl, butoxyoctadecyl, butoxynonadecyl, butoxyeicosyl, butoxyheneicosyl, butoxydocosyl, butoxytricosyl, butoxytetracosyl, butoxypentacosyl, butoxyhexacosyl, butoxyheptacosyl, butoxyoctacosyl, butoxynonacosyl, butoxytriacontyl, dimethylaminopropyl, dimethylaminobutyl, dimethylaminopentyl, dimethylaminohexyl, dimethylaminoheptyl, dimethylaminooctyl, dimethylaminononyl, dimethylaminodecyl, dimethylaminoundecyl, dimethylaminododecyl, dimethylaminotridecyl, dimethylaminotetradecyl, dimethylaminopentadecyl, dimethylaminohexadecyl, dimethylaminoheptadecyl, dimethylaminooctadecyl, dimethylaminononadecyl, dimethylaminoeicosyl, dimethylaminoheneicosyl, dimethylaminodocosyl, dimethylaminotricosyl, dimethylaminotetracosyl, dimethylaminopentacosyl, dimethylaminohexacosyl, dimethylaminoheptacosyl, dimethylaminooctacosyl, dimethylaminononacosyl, dimethylaminotriacontyl, trimethylsilylpropyl, trimethylsilylbutyl, trimethylsilylpentyl, trimethylsilylhexyl, trimethylsilylheptyl, trimethylsilyloctyl, trimethylsilylnonyl, trimethylsilyldecyl, trimethylsilylundecyl, trimethylsilyldodecyl, trimethylsilyltridecyl, trimethylsilyltetradecyl, trimethylsilylpentadecyl, trimethylsilylhexadecyl, trimethylsilylheptadecyl, trimethylsilyloctadecyl, trimethylsilylnonadecyl, trimethylsilyleicosyl, trimethylsilylheneicosyl, trimethylsilyldocosyl, trimethylsilyltricosyl, trimethylsilyltetracosyl, trimethylsilylpentacosyl, trimethylsilylhexacosyl, trimethylsilylheptacosyl, trimethylsilyloctacosyl, trimethylsilylnonacosyl, trimethylsilyltriacontyl and the like; from phenyl, and all isomers of hydrocarbyl substituted phenyl including methylphenyl, dimethylphenyl, trimethylphenyl, tetramethylphenyl, pentamethylphenyl ethylphenyl, diethylphenyl, triethylphenyl, tetraethylphenyl, pentaethylphenyl, propylphenyl, dipropylphenyl, tripropylphenyl, tetrapropylphenyl, pentapropylphenyl butylphenyl, dibutylphenyl, tributylphenyl, tetrabutylphenyl, pentabutylphenyl, hexylphenyl, dihexylphenyl, trihexylphenyl, tetrahexylphenyl, pentahexylphenyl, dimethylethylphenyl, dimethylpropylphenyl, dimethylbutylphenyl, dimethylpentylphenyl, dimethylhexylphenyl, diethylmethylphenyl, diethylpropylphenyl, diethylbutylphenyl, diethylpentylphenyl, diethylhexylphenyl, dipropylmethylphenyl, dipropylethylphenyl, dipropylbutylphenyl, dipropylpentylphenyl, dipropylhexylphenyl, dibutylmethylphenyl, dibutylethylphenyl, dibutylpropylphenyl, dibutylpentylphenyl,

dibutylhexylphenyl, methylethylphenyl, methylpropylphenyl, methylbutylphenyl, methylpentylphenyl, methylhexylphenyl, ethylpropylphenyl, ethylbutylphenyl, ethylpentylphenyl, ethylhexylphenyl, propylbutylphenyl, propylpentylphenyl, propylhexylphenyl, butylpentylphenyl, butylhexylphenyl, trimethylsilylphenyl, trimethylgermylphenyl, trifluoromethylphenyl, bis(triflouromethyl)phenyl and the like; from all isomers of halo substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halophenyl, dihalophenyl, trihalophenyl, tetrahalophenyl, and pentahalophenyl; from all isomers of halo substituted hydrocarbyl substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halomethylphenyl, dihalomethylphenyl, trihalomethylphenyl, tetrahalomethylphenyl, haloethlyphenyl, dihaloethylphenyl, trihaloethylphenyl, tetrahaloethylphenyl, halopropylphenyl, dihalopropylphenyl, trihalopropylphenyl, tetrahalopropylphenyl, halobutylphenyl, dihalobutylphenyl, trihalobutylphenyl, tetrahalobutylphenyl, dihalodimethylphenyl, dihalo(trifluoromethyl)phenyl and the like; from all isomers of benzyl, and all isomers of hydrocarbyl substituted benzyl including methylbenzyl, dimethylbenzyl, trimethylbenzyl, tetramethylbenzyl, pentamethylbenzyl ethylbenzyl, diethylbenzyl, triethylbenzyl, tetraethylbenzyl, pentaethylbenzyl, propylbenzyl, dipropylbenzyl, tripropylbenzyl, tetrapropylbenzyl, pentapropylbenzyl butylbenzyl, dibutylbenzyl, tributylbenzyl, tetrabutylbenzyl, pentabutylbenzyl, hexylbenzyl, dihexylbenzyl, trihexylbenzyl, tetrahexylbenzyl, pentahexylbenzyl, dimethylethylbenzyl, dimethylpropylbenzyl, dimethylbutylbenzyl, dimethylpentylbenzyl, dimethylhexylbenzyl, diethylmethylbenzyl, diethylpropylbenzyl, diethylbutylbenzyl, diethylpentylbenzyl, diethylhexylbenzyl, dipropylmethylbenzyl, dipropylethylbenzyl, dipropylbutylbenzyl, dipropylpentylbenzyl, dipropylhexylbenzyl, dibutylmethylbenzyl, dibutylethylbenzyl, dibutylpropylbenzyl, dibutylpentylbenzyl, dibutylhexylbenzyl, methylethylbenzyl, methylpropylbenzyl, methylbutylbenzyl, methylpentylbenzyl, methylhexylbenzyl, ethylpropylbenzyl, ethylbutylbenzyl, ethylpentylbenzyl, ethylhexylbenzyl, propylbutylbenzyl, propylpentylbenzyl, propylhexylbenzyl, butylpentylbenzyl, butylhexylbenzyl, trimethylsilylbenzyl, bis(trimethylsilyl)benzyl, trimethylgermylbenzyl, diphenylmethyl and the like; from trihydrocarbyl-silyl, – germyls, -stannyls and -plumbyls including trimethylsilyl, trimethylgermyl, trimethylstannyl, trimethylplumbyl, triethylsilyl, triethylgermyl, dimethylethylsilyl,

dimethylethylgermyl, diethylmethylsilyl, diethylmethylgermyl, triphenylsilyl, triphenylgermyl, and all isomers of tripropylsilyl, tripropylgermyl, tributylsilyl, tributylgermyl, tris(trifluormethyl)silyl, bis(perfluoromethyl)methylsilyl, and the like; from all isomers and hydrocarbyl substituted isomers of polycyclic areneyls including pyrenyl, aceanthrylenyl, acenaphthylene, acephenanthrylenyl, azulenyl biphenylenyl, chrysenyl, coronenyl, fluoranthenyl, fluorenyl, heptacenyl, heptalenyl, heptaphenyl, hexacenyl, hexaphenyl, *as*-indacenyl, *s*-indecenyl, indenyl, ovalenyl, pentacenyl, pentalenyl, pentaphenyl, perylenyl, phenalenyl, phenanthrenyl, picenyl, pleiadenyl, pyranhrenyl, rubicenyl, naphthacenyl, tetraphenylenyl, trinaphthylenyl, triphenylenyl, hexahelicenyl, naphthyl, anthracenyl, dibenza[*a,b*]anthracenyl, indanyl, acenaphthenyl, cholanthrenyl, aceanthrenyl, acephenanthrenyl, 1,2,3,4-tetrahydronapthalene, fullerenyl, and the like; from all isomers and hydrocarbyl substituted isomers of alicyclic monocyclic and polycyclic hydrocarbon rings including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, and cyclododecyl, dimethylcyclohexyl, norbornyl, norbornenyl, adamantyl, cubanyl, prismanyl, spiro[4,5]decanyl, and the like; from all isomers and hydrocarbyl substituted isomers of ring assemblies including biphenyl, bicyclopentyl, terphenyl, quatercyclohexanyl, binaphthyl, binorbornyl, phenyl-terphenyl, and the like; from all isomers and hydrocarbyl substituted isomers of bridged monocyclic and polycyclic arenyls including 1,1-diphenylmethano, 1,1-dinapthyletheno, and the like; from all isomers of heterocycles and hydrocarbyl substituted heterocycles including acridarsinyl, acridinyl, acridophosphinyl, 1*H*-acrindolinyl, anthrazinyl, anthyridinyl, arsanthridinyl, arsindolyl, arsindolizinyl, arsinolinyl, arsinolizinyl, benzofuranyl, carbazolyl, β-carbolinyl, chromenyl, thiochromenyl, cinnolinyl, furanyl, imidazolyl, indazolyl, indolyl, indolizinyl, isoarsindolyl, isoarsinolinyl, isobenzofuranyl, isochromenyl, isothiochromenyl, isoindolyl, isophosphindolyl, isophosphinolinyl, isoquinolinyl, isothiazolyl, isoxazolyl, naphthyridinyl, oxazolyl, perimidinyl, phenanthrazinyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phosphanthridinyl, phosphindolyl, phosphindolizinyl, phosphinolizinyl, phthalazinyl, pteridinyl, phthaloperinyl, purinyl, pyranyl, thiopyranal, pyrazinyl, pyrazolyl, pyridazinyl, pyridinyl, pyrindinyl, pyrimidinyl, pyrrolyl, pyrrolizinyl, quinazolinyl, quindolinyl, 1*H*-quinindolinyl, quinolinyl, quinolizinyl, quinoxalinyl, selenophenyl, thebenidinyl, thiazolyl,

thiophenyl, triphenodioxazinyl, triphenodithiazinyl, xanthenyl, chromanyl, thiochromanyl, imidazolidinyl, indolinyl, isochromanyl, isothiochromanyl, isoindolinyl, morpholinyl, piperazinyl, piperidinyl, pyrozolidinyl, pyrrolidinyl, quinuclidinyl, dimethylacridarsinyl, dimethylacridinyl, dimethylacridophosphinyl, dimethyl-1*H*-acrindolinyl, dimethylanthrazinyl, dimethylanthyridinyl, dimethylarsanthridinyl, dimethylarsindolyl, dimethylarsindolizinyl, dimethylarsinolinyl, dimethylarsinolizinyl, dibutylbenzofuranyl, dibutylcarbazolyl, dibutyl-β-carbolinyl, dibutylchromenyl, dibutylthiochromenyl, butylcinnolinyl, dibutylfuranyl, dimethylimidazolyl, dimethylindazolyl, dipropylindolyl, dipropylindolizinyl, dimethylisoarsindolyl, methylisoarsinolinyl, dimethylisobenzofuranyl, diphenylisochromenyl, dibutylisothiochromenyl, phenylisoindolyl, butylisophosphindolyl, dibutylisophosphinolinyl, dimethylisoquinolinyl, methylisothiazolyl, butylisoxazolyl, butylnaphthyridinyl, dimethyloxazolyl, methylphenylperimidinyl, tetrabutylphenanthrazinyl, propylphenanthridinyl, dibutylphenanthrolinyl, tetramethylphenazinyl, butylphosphanthridinyl, phenylphosphindolyl, dimethylphosphindolizinyl, methylphosphinolizinyl, dibutylphthalazinyl, trimethylpteridinyl, methylphthaloperinyl, dimethylpurinyl, dibutylpyranyl, dibutylthiopyranal, trimethylpyrazinyl, phenylpyrazolyl, dipropylpyridazinyl, dimethylpyridinyl, methylpropylpyrindinyl, triethylpyrimidinyl, dibutylpyrrolyl, diethylpyrrolizinyl, dibutylquinazolinyl, dibutylquindolinyl, dibutyl-1*H*-quinindolinyl, dimethylquinolinyl, propylquinolizinyl, methylquinoxalinyl, methylbutylselenophenyl, methylthebenidinyl, dimethylthiazolyl, trimethylthiophenyl, dibutyltriphenodioxazinyl, dibutyltriphenodithiazinyl, dibutylxanthenyl, trimethylchromanyl, dimethylthiochromanyl, dimethylimidazolidinyl, dimethylindolinyl, dibutylisochromanyl, dibutylisothiochromanyl, phenylisoindolinyl, dibutylmorpholinyl, dimethylpiperazinyl, dimethylpiperidinyl, dimethylpyrozolidinyl, dimethylpyrrolidinyl, bipyridyl, pyrido[2,1,6-*de*]quinolizinyl, hexamethylquinuclidinyl, 5,7-dioxa-6-phosphadibenzo[*a,c*]cycloheptene-6-oxide, 9-oxa-10-phosphaphenanthrene-10-oxide and the like; from all isomers of polar groups including methoxy, ethoxy, propoxy, butoxy, pentoxy, phenoxy, dimethylphenoxy, dimethylamino, diethylamino, dipropylamino, methylethylamino,

methylpropylamino, ethylpropylamino, diphenylamino, methylphenylamino, ethylphenylamino, and the like.

In some embodiments of the invention, it is preferred that at least one R^{11} and/or at least one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl; more preferably at least one R^{11} and one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl.

In some embodiments R^{10}, R^{11}, R^{12}, and R^{13} on the same atom or adjacent atoms may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

Preferred catecholate ligands, X, are selected from the ZETA CATACHOLATES which is defined to be all isomers of methylcatecholate, dimethylcatecholate, trimethylcatecholate, tetramethylcatecholate, dichlorodimethylcatecholate, chloromethylcatecholate, chlorodimethylcatecholate, chlorotrimethylcatecholate, dichloromethylcatecholate, methyltrichlorocatecholate, difluorodimethylcatecholate, fluoromethylcatecholate, fluorodimethylcatecholate, fluorotrimethylcatecholate, difluoromethylcatecholate, methyltrifluorocatecholate, dibromodimethylcatecholate, bromomethylcatecholate, bromodimethylcatecholate, bromotrimethylcatecholate, dibromomethylcatecholate, methyltribromocatecholate, diiododimethylcatecholate, iodomethylcatecholate, iododimethylcatecholate, iodotrimethylcatecholate, diiodomethylcatecholate, methyltriiodocatecholate, methylnitrocatecholate, dimethylnitrocatecholate, trimethylnitrocatecholate, dimethoxydimethylcatecholate, diethoxydimethylcatecholate, dimethyldipropoxycatecholate, dibutoxydimethylcatecholate, dimethyldipentyloxycatecholate, dihexyloxydimethylcatecholate, diheptyloxydimethylcatecholate, dimethyldioctyloxycatecholate, dimethyldinonyloxycatecholate, didecyloxydimethylcatecholate, dimethylmethoxycatecholate, dimethylethoxycatecholate, dimethylpropoxycatecholate, butoxydimethylcatecholate,

dimethylpentyloxycatecholate, dimethylhexyloxycatecholate, dimethylheptyloxycatecholate, dimethyloctyloxycatecholate, dimethylnonyloxycatecholate, decyloxydimethylcatecholate, methylmethoxycatecholate, methylethoxycatecholate, methylpropoxycatecholate, butoxymethylcatecholate, methylpentyloxycatecholate, hexyloxymethylcatecholate, heptyloxymethylcatecholate, methyloctyloxycatecholate, methylnonyloxycatecholate, decyloxymethylcatecholate, methyltrimethoxycatecholate, methyltriethoxycatecholate, methyltripropoxycatecholate, methyltributoxycatecholate, methyltripentyloxycatecholate, methyltrihexyloxycatecholate, methyltriheptyloxycatecholate, methyltrioctyloxycatecholate, methyltrinonyloxycatecholate, methyltridecyloxycatecholate, dimethoxymethylcatecholate, diethoxymethylcatecholate, dipropoxymethylcatecholate, dibutoxymethylcatecholate, diipentyloxymethylcatecholate, dihexyloxymethylcatecholate, diheptyloxymethylcatecholate, dioctyloxymethylcatecholate, dinonyloxymethylcatecholate, didecyloxymethylcatecholate, methoxytrimethylcatecholate, ethoxytrimethylcatecholate, propoxytrimethylcatecholate, butoxytrimethylcatecholate, pentyloxytrimethylcatecholate, hexyloxytrimethylcatecholate, heptyloxytrimethylcatecholate, octyloxytrimethylcatecholate, nonyloxytrimethylcatecholate, decyloxytrimethylcatecholate, ethylcatecholate, diethylcatecholate, triethylcatecholate, tetraethylcatecholate, dichlorodiethylcatecholate, chloroethylcatecholate, chlorodiethylcatecholate, chlorotriethylcatecholate, dichloroethylcatecholate, ethyltrichlorocatecholate, difluorodiethylcatecholate, fluoroethylcatecholate, fluorodiethylcatecholate, fluorotriethylcatecholate, difluoroethylcatecholate, ethyltrifluorocatecholate, dibromodiethylcatecholate, bromoethylcatecholate, bromodiethylcatecholate, bromotriethylcatecholate, dibromoethylcatecholate, ethyltribromocatecholate, diiododiethylcatecholate, iodoethylcatecholate, iododiethylcatecholate, iodotriethylcatecholate, diiodoethylcatecholate, ethyltriiodocatecholate, ethylnitrocatecholate, diethylnitrocatecholate, triethylnitrocatecholate, dimethoxydiethylcatecholate, diethoxydiethylcatecholate, diethyldipropoxycatecholate, dibutoxydiethylcatecholate,

diethyldipentyloxycatecholate, dihexyloxydiethylcatecholate, diheptyloxydiethylcatecholate, diethyldioctyloxycatecholate, diethyldinonyloxycatecholate, didecyloxydiethylcatecholate, diethylmethoxycatecholate, diethylethoxycatecholate, diethylpropoxycatecholate, butoxydiethylcatecholate, diethylpentyloxycatecholate, diethylhexyloxycatecholate, diethylheptyloxycatecholate, diethyloctyloxycatecholate, diethylnonyloxycatecholate, decyloxydiethylcatecholate, ethylmethoxycatecholate, ethylethoxycatecholate, ethylpropoxycatecholate, butoxyethylcatecholate, ethylpentyloxycatecholate, hexyloxyethylcatecholate, heptyloxyethylcatecholate, ethyloctyloxycatecholate, ethylnonyloxycatecholate, decyloxyethylcatecholate, ethyltrimethoxycatecholate, ethyltriethoxycatecholate, ethyltripropoxycatecholate, ethyltributoxycatecholate, ethyltripentyloxycatecholate, ethyltrihexyloxycatecholate, ethyltriheptyloxycatecholate, ethyltrioctyloxycatecholate, ethyltrinonyloxycatecholate, ethyltridecyloxycatecholate, dimethoxyethylcatecholate, diethoxyethylcatecholate, dipropoxyethylcatecholate, dibutoxyethylcatecholate, diipentyloxyethylcatecholate, dihexyloxyethylcatecholate, diheptyloxyethylcatecholate, dioctyloxyethylcatecholate, dinonyloxyethylcatecholate, didecyloxyethylcatecholate, methoxytriethylcatecholate, ethoxytriethylcatecholate, propoxytriethylcatecholate, butoxytriethylcatecholate, pentyloxytriethylcatecholate, hexyloxytriethylcatecholate, heptyloxytriethylcatecholate, octyloxytriethylcatecholate, nonyloxytriethylcatecholate, decyloxytriethylcatecholate, propylcatecholate, dipropylcatecholate, tripropylcatecholate, tetrapropylcatecholate, dichlorodipropylcatecholate, chloropropylcatecholate, chlorodipropylcatecholate, chlorotripropylcatecholate, dichloropropylcatecholate, propyltrichlorocatecholate, difluorodipropylcatecholate, fluoropropylcatecholate, fluorodipropylcatecholate, fluorotripropylcatecholate, difluoropropylcatecholate, propyltrifluorocatecholate, dibromodipropylcatecholate, bromopropylcatecholate, bromodipropylcatecholate, bromotripropylcatecholate, dibromopropylcatecholate, propyltribromocatecholate, diiododipropylcatecholate, iodopropylcatecholate, iododipropylcatecholate, iodotripropylcatecholate, diiodopropylcatecholate, propyltriiodocatecholate, propylnitrocatecholate, dipropylnitrocatecholate, tripropylnitrocatecholate, dimethoxydipropylcatecholate, diethoxydipropylcatecholate, dipropyldipropoxycatecholate, dibutoxydipropylcatecholate,

dipropyldipentyloxycatecholate, dihexyloxydipropylcatecholate, diheptyloxydipropylcatecholate, dipropyldioctyloxycatecholate, dipropyldinonyloxycatecholate, didecyloxydipropylcatecholate, dipropylmethoxycatecholate, dipropylethoxycatecholate, dipropylpropoxycatecholate, butoxydipropylcatecholate, dipropylpentyloxycatecholate, dipropylhexyloxycatecholate, dipropylheptyloxycatecholate, dipropyloctyloxycatecholate, dipropylnonyloxycatecholate, decyloxydipropylcatecholate, propylmethoxycatecholate, propylethoxycatecholate, propylpropoxycatecholate, butoxypropylcatecholate, propylpentyloxycatecholate, hexyloxypropylcatecholate, heptyloxypropylcatecholate, propyloctyloxycatecholate, propylnonyloxycatecholate, decyloxypropylcatecholate, propyltrimethoxycatecholate, propyltriethoxycatecholate, propyltripropoxycatecholate, propyltributoxycatecholate, propyltripentyloxycatecholate, propyltrihexyloxycatecholate, propyltriheptyloxycatecholate, propyltrioctyloxycatecholate, propyltrinonyloxycatecholate, propyltridecyloxycatecholate, dimethoxypropylcatecholate, diethoxypropylcatecholate, dipropoxypropylcatecholate, dibutoxypropylcatecholate, diipentyloxypropylcatecholate, dihexyloxypropylcatecholate, diheptyloxypropylcatecholate, dioctyloxypropylcatecholate, dinonyloxypropylcatecholate, didecyloxypropylcatecholate, methoxytripropylcatecholate, ethoxytripropylcatecholate, propoxytripropylcatecholate, butoxytripropylcatecholate, pentyloxytripropylcatecholate, hexyloxytripropylcatecholate, heptyloxytripropylcatecholate, octyloxytripropylcatecholate, nonyloxytripropylcatecholate, decyloxytripropylcatecholate, butylcatecholate, dibutylcatecholate, tributylcatecholate, tetrabutylcatecholate, dichlorodibutylcatecholate, chlorobutylcatecholate, chlorodibutylcatecholate, chlorotributylcatecholate, dichlorobutylcatecholate, butyltrichlorocatecholate, difluorodibutylcatecholate, fluorobutylcatecholate, fluorodibutylcatecholate, fluorotributylcatecholate, difluorobutylcatecholate, butyltrifluorocatecholate, dibromodibutylcatecholate, bromobutylcatecholate, bromodibutylcatecholate, bromotributylcatecholate, dibromobutylcatecholate, butyltribromocatecholate, diiododibutylcatecholate, iodobutylcatecholate, iododibutylcatecholate, iodotributylcatecholate, diiodobutylcatecholate, butyltriiodocatecholate,

butylnitrocatecholate, dibutylnitrocatecholate, tributylnitrocatecholate, dimethoxydibutylcatecholate, diethoxydibutylcatecholate, dibutyldipropoxycatecholate, dibutoxydibutylcatecholate, dibutyldipentyloxycatecholate, dihexyloxydibutylcatecholate, diheptyloxydibutylcatecholate, dibutyldioctyloxycatecholate, dibutyldinonyloxycatecholate, didecyloxydibutylcatecholate, dibutylmethoxycatecholate, dibutylethoxycatecholate, dibutylpropoxycatecholate, butoxydibutylcatecholate, dibutylpentyloxycatecholate, dibutylhexyloxycatecholate, dibutylheptyloxycatecholate, dibutyloctyloxycatecholate, dibutylnonyloxycatecholate, decyloxydibutylcatecholate, butylmethoxycatecholate, butylethoxycatecholate, butylpropoxycatecholate, butoxybutylcatecholate, butylpentyloxycatecholate, hexyloxybutylcatecholate, heptyloxybutylcatecholate, butyloctyloxycatecholate, butylnonyloxycatecholate, decyloxybutylcatecholate, butyltrimethoxycatecholate, butyltriethoxycatecholate, butyltripropoxycatecholate, butyltributoxycatecholate, butyltripentyloxycatecholate, butyltrihexyloxycatecholate, butyltriheptyloxycatecholate, butyltrioctyloxycatecholate, butyltrinonyloxycatecholate, butyltridecyloxycatecholate, dimethoxybutylcatecholate, diethoxybutylcatecholate, dipropoxybutylcatecholate, dibutoxybutylcatecholate, diipentyloxybutylcatecholate, dihexyloxybutylcatecholate, diheptyloxybutylcatecholate, dioctyloxybutylcatecholate, dinonyloxybutylcatecholate, didecyloxybutylcatecholate, methoxytributylcatecholate, ethoxytributylcatecholate, propoxytributylcatecholate, butoxytributylcatecholate, pentyloxytributylcatecholate, hexyloxytributylcatecholate, heptyloxytributylcatecholate, octyloxytributylcatecholate, nonyloxytributylcatecholate, decyloxytributylcatecholate, pentylcatecholate, dipentylcatecholate, tripentylcatecholate, tetrapentylcatecholate, dichlorodipentylcatecholate, chloropentylcatecholate, chlorodipentylcatecholate, chlorotripentylcatecholate, dichloropentylcatecholate, pentyltrichlorocatecholate, difluorodipentylcatecholate, fluoropentylcatecholate, fluorodipentylcatecholate, fluorotripentylcatecholate, difluoropentylcatecholate, pentyltrifluorocatecholate, dibromodipentylcatecholate, bromopentylcatecholate, bromodipentylcatecholate, bromotripentylcatecholate, dibromopentylcatecholate, pentyltribromocatecholate, diiododipentylcatecholate, iodopentylcatecholate, iododipentylcatecholate, iodotripentylcatecholate, diiodopentylcatecholate, pentyltriiodocatecholate,

pentylnitrocatecholate, dipentylnitrocatecholate, tripentylnitrocatecholate, dimethoxydipentylcatecholate, diethoxydipentylcatecholate, dipentyldipropoxycatecholate, dibutoxydipentylcatecholate, dipentyldipentyloxycatecholate, dihexyloxydipentylcatecholate, diheptyloxydipentylcatecholate, dipentyldioctyloxycatecholate, dipentyldinonyloxycatecholate, didecyloxydipentylcatecholate, dipentylmethoxycatecholate, dipentylethoxycatecholate, dipentylpropoxycatecholate, butoxydipentylcatecholate, dipentylpentyloxycatecholate, dipentylhexyloxycatecholate, dipentylheptyloxycatecholate, dipentyloctyloxycatecholate, dipentylnonyloxycatecholate, decyloxydipentylcatecholate, pentylmethoxycatecholate, pentylethoxycatecholate, pentylpropoxycatecholate, butoxypentylcatecholate, pentylpentyloxycatecholate, hexyloxypentylcatecholate, heptyloxypentylcatecholate, pentyloctyloxycatecholate, pentylnonyloxycatecholate, decyloxypentylcatecholate, pentyltrimethoxycatecholate, pentyltriethoxycatecholate, pentyltripropoxycatecholate, pentyltributoxycatecholate, pentyltripentyloxycatecholate, pentyltrihexyloxycatecholate, pentyltriheptyloxycatecholate, pentyltrioctyloxycatecholate, pentyltrinonyloxycatecholate, pentyltridecyloxycatecholate, dimethoxypentylcatecholate, diethoxypentylcatecholate, dipropoxypentylcatecholate, dibutoxypentylcatecholate, diipentyloxypentylcatecholate, dihexyloxypentylcatecholate, diheptyloxypentylcatecholate, dioctyloxypentylcatecholate, dinonyloxypentylcatecholate, didecyloxypentylcatecholate, methoxytripentylcatecholate, ethoxytripentylcatecholate, propoxytripentylcatecholate, butoxytripentylcatecholate, pentyloxytripentylcatecholate, hexyloxytripentylcatecholate, heptyloxytripentylcatecholate, octyloxytripentylcatecholate, nonyloxytripentylcatecholate, decyloxytripentylcatecholate, hexylcatecholate, dihexylcatecholate, trihexylcatecholate, tetrahexylcatecholate, dichlorodihexylcatecholate, chlorohexylcatecholate, chlorodihexylcatecholate, chlorotrihexylcatecholate, dichlorohexylcatecholate, hexyltrichlorocatecholate, difluorodihexylcatecholate, fluorohexylcatecholate, fluorodihexylcatecholate, fluorotrihexylcatecholate, difluorohexylcatecholate, hexyltrifluorocatecholate, dibromodihexylcatecholate, bromohexylcatecholate, bromodihexylcatecholate,

bromotrihexylcatecholate, dibromohexylcatecholate, hexyltribromocatecholate, diiododihexylcatecholate, iodohexylcatecholate, iododihexylcatecholate, iodotrihexylcatecholate, diiodohexylcatecholate, hexyltriiodocatecholate, hexylnitrocatecholate, dihexylnitrocatecholate, trihexylnitrocatecholate, dimethoxydihexylcatecholate, diethoxydihexylcatecholate, dihexyldipropoxycatecholate, dibutoxydihexylcatecholate, dihexyldipentyloxycatecholate, dihexyloxydihexylcatecholate, diheptyloxydihexylcatecholate, dihexyldioctyloxycatecholate, dihexyldinonyloxycatecholate, didecyloxydihexylcatecholate, dihexylmethoxycatecholate, dihexylethoxycatecholate, dihexylpropoxycatecholate, butoxydihexylcatecholate, dihexylpentyloxycatecholate, dihexylhexyloxycatecholate, dihexylheptyloxycatecholate, dihexyloctyloxycatecholate, dihexylnonyloxycatecholate, decyloxydihexylcatecholate, hexylmethoxycatecholate, hexylethoxycatecholate, hexylpropoxycatecholate, butoxyhexylcatecholate, hexylpentyloxycatecholate, hexyloxyhexylcatecholate, heptyloxyhexylcatecholate, hexyloctyloxycatecholate, hexylnonyloxycatecholate, decyloxyhexylcatecholate, hexyltrimethoxycatecholate, hexyltriethoxycatecholate, hexyltripropoxycatecholate, hexyltributoxycatecholate, hexyltripentyloxycatecholate, hexyltrihexyloxycatecholate, hexyltriheptyloxycatecholate, hexyltrioctyloxycatecholate, hexyltrinonyloxycatecholate, hexyltridecyloxycatecholate, dimethoxyhexylcatecholate, diethoxyhexylcatecholate, dipropoxyhexylcatecholate, dibutoxyhexylcatecholate, diipentyloxyhexylcatecholate, dihexyloxyhexylcatecholate, diheptyloxyhexylcatecholate, dioctyloxyhexylcatecholate, dinonyloxyhexylcatecholate, didecyloxyhexylcatecholate, methoxytrihexylcatecholate, ethoxytrihexylcatecholate, propoxytrihexylcatecholate, butoxytrihexylcatecholate, pentyloxytrihexylcatecholate, hexyloxytrihexylcatecholate, heptyloxytrihexylcatecholate, octyloxytrihexylcatecholate, nonyloxytrihexylcatecholate, decyloxytrihexylcatecholate, heptylcatecholate, diheptylcatecholate, triheptylcatecholate, tetraheptylcatecholate, dichlorodiheptylcatecholate, chloroheptylcatecholate, chlorodiheptylcatecholate, chlorotriheptylcatecholate, dichloroheptylcatecholate, heptyltrichlorocatecholate, difluorodiheptylcatecholate, fluoroheptylcatecholate, fluorodiheptylcatecholate, fluorotriheptylcatecholate, difluoroheptylcatecholate, heptyltrifluorocatecholate,

dibromodiheptylcatecholate, bromoheptylcatecholate, bromodiheptylcatecholate, bromotriheptylcatecholate, dibromoheptylcatecholate, heptyltribromocatecholate, diiododiheptylcatecholate, iodoheptylcatecholate, iododiheptylcatecholate, iodotriheptylcatecholate, diiodoheptylcatecholate, heptyltriiodocatecholate, heptylnitrocatecholate, diheptylnitrocatecholate, triheptylnitrocatecholate, dimethoxydiheptylcatecholate, diethoxydiheptylcatecholate, diheptyldipropoxycatecholate, dibutoxydiheptylcatecholate, diheptyldipentyloxycatecholate, dihexyloxydiheptylcatecholate, diheptyloxydiheptylcatecholate, diheptyldioctyloxycatecholate, diheptyldinonyloxycatecholate, didecyloxydiheptylcatecholate, diheptylmethoxycatecholate, diheptylethoxycatecholate, diheptylpropoxycatecholate, butoxydiheptylcatecholate, diheptylpentyloxycatecholate, diheptylhexyloxycatecholate, diheptylheptyloxycatecholate, diheptyloctyloxycatecholate, diheptylnonyloxycatecholate, decyloxydiheptylcatecholate, heptylmethoxycatecholate, heptylethoxycatecholate, heptylpropoxycatecholate, butoxyheptylcatecholate, heptylpentyloxycatecholate, hexyloxyheptylcatecholate, heptyloxyheptylcatecholate, heptyloctyloxycatecholate, heptylnonyloxycatecholate, decyloxyheptylcatecholate, heptyltrimethoxycatecholate, heptyltriethoxycatecholate, heptyltripropoxycatecholate, heptyltributoxycatecholate, heptyltripentyloxycatecholate, heptyltrihexyloxycatecholate, heptyltriheptyloxycatecholate, heptyltrioctyloxycatecholate, heptyltrinonyloxycatecholate, heptyltridecyloxycatecholate, dimethoxyheptylcatecholate, diethoxyheptylcatecholate, dipropoxyheptylcatecholate, dibutoxyheptylcatecholate, diipentyloxyheptylcatecholate, dihexyloxyheptylcatecholate, diheptyloxyheptylcatecholate, dioctyloxyheptylcatecholate, dinonyloxyheptylcatecholate, didecyloxyheptylcatecholate, methoxytriheptylcatecholate, ethoxytriheptylcatecholate, propoxytriheptylcatecholate, butoxytriheptylcatecholate, pentyloxytriheptylcatecholate, hexyloxytriheptylcatecholate, heptyloxytriheptylcatecholate, octyloxytriheptylcatecholate, nonyloxytriheptylcatecholate, decyloxytriheptylcatecholate, octylcatecholate, dioctylcatecholate, trioctylcatecholate, tetraoctylcatecholate, dichlorodioctylcatecholate, chlorooctylcatecholate, chlorodioctylcatecholate,

chlorotrioctylcatecholate, dichlorooctylcatecholate, octyltrichlorocatecholate, difluorodioctylcatecholate, fluorooctylcatecholate, fluorodioctylcatecholate, fluorotrioctylcatecholate, difluorooctylcatecholate, octyltrifluorocatecholate, dibromodioctylcatecholate, bromooctylcatecholate, bromodioctylcatecholate, bromotrioctylcatecholate, dibromooctylcatecholate, octyltribromocatecholate, diiododioctylcatecholate, iodooctylcatecholate, iododioctylcatecholate, iodotrioctylcatecholate, diiodooctylcatecholate, octyltriiodocatecholate, octylnitrocatecholate, dioctylnitrocatecholate, trioctylnitrocatecholate, dimethoxydioctylcatecholate, diethoxydioctylcatecholate, dioctyldipropoxycatecholate, dibutoxydioctylcatecholate, dioctyldipentyloxycatecholate, dihexyloxydioctylcatecholate, diheptyloxydioctylcatecholate, dioctyldioctyloxycatecholate, dioctyldinonyloxycatecholate, didecyloxydioctylcatecholate, dioctylmethoxycatecholate, dioctylethoxycatecholate, dioctylpropoxycatecholate, butoxydioctylcatecholate, dioctylpentyloxycatecholate, dioctylhexyloxycatecholate, dioctylheptyloxycatecholate, dioctyloctyloxycatecholate, dioctylnonyloxycatecholate, decyloxydioctylcatecholate, octylmethoxycatecholate, octylethoxycatecholate, octylpropoxycatecholate, butoxyoctylcatecholate, octylpentyloxycatecholate, hexyloxyoctylcatecholate, heptyloxyoctylcatecholate, octyloctyloxycatecholate, octylnonyloxycatecholate, decyloxyoctylcatecholate, octyltrimethoxycatecholate, octyltriethoxycatecholate, octyltripropoxycatecholate, octyltributoxycatecholate, octyltripentyloxycatecholate, octyltrihexyloxycatecholate, octyltriheptyloxycatecholate, octyltrioctyloxycatecholate, octyltrinonyloxycatecholate, octyltridecyloxycatecholate, dimethoxyoctylcatecholate, diethoxyoctylcatecholate, dipropoxyoctylcatecholate, dibutoxyoctylcatecholate, diipentyloxyoctylcatecholate, dihexyloxyoctylcatecholate, diheptyloxyoctylcatecholate, dioctyloxyoctylcatecholate, dinonyloxyoctylcatecholate, didecyloxyoctylcatecholate, methoxytrioctylcatecholate, ethoxytrioctylcatecholate, propoxytrioctylcatecholate, butoxytrioctylcatecholate, pentyloxytrioctylcatecholate, hexyloxytrioctylcatecholate, heptyloxytrioctylcatecholate, octyloxytrioctylcatecholate, nonyloxytrioctylcatecholate, decyloxytrioctylcatecholate, nonylcatecholate, dinonylcatecholate, trinonylcatecholate, tetranonylcatecholate, dichlorodinonylcatecholate, chlorononylcatecholate, chlorodinonylcatecholate,

chlorotrinonylcatecholate, dichlorononylcatecholate, nonyltrichlorocatecholate, difluorodinonylcatecholate, fluorononylcatecholate, fluorodinonylcatecholate, fluorotrinonylcatecholate, difluorononylcatecholate, nonyltrifluorocatecholate, dibromodinonylcatecholate, bromononylcatecholate, bromodinonylcatecholate, bromotrinonylcatecholate, dibromononylcatecholate, nonyltribromocatecholate, diiododinonylcatecholate, iodononylcatecholate, iododinonylcatecholate, iodotrinonylcatecholate, diiodononylcatecholate, nonyltriiodocatecholate, nonylnitrocatecholate, dinonylnitrocatecholate, trinonylnitrocatecholate, dimethoxydinonylcatecholate, diethoxydinonylcatecholate, dinonyldipropoxycatecholate, dibutoxydinonylcatecholate, dinonyldipentyloxycatecholate, dihexyloxydinonylcatecholate, diheptyloxydinonylcatecholate, dinonyldioctyloxycatecholate, dinonyldinonyloxycatecholate, didecyloxydinonylcatecholate, dinonylmethoxycatecholate, dinonylethoxycatecholate, dinonylpropoxycatecholate, butoxydinonylcatecholate, dinonylpentyloxycatecholate, dinonylhexyloxycatecholate, dinonylheptyloxycatecholate, dinonyloctyloxycatecholate, dinonylnonyloxycatecholate, decyloxydinonylcatecholate, nonylmethoxycatecholate, nonylethoxycatecholate, nonylpropoxycatecholate, butoxynonylcatecholate, nonylpentyloxycatecholate, hexyloxynonylcatecholate, heptyloxynonylcatecholate, nonyloctyloxycatecholate, nonylnonyloxycatecholate, decyloxynonylcatecholate, nonyltrimethoxycatecholate, nonyltriethoxycatecholate, nonyltripropoxycatecholate, nonyltributoxycatecholate, nonyltripentyloxycatecholate, nonyltrihexyloxycatecholate, nonyltriheptyloxycatecholate, nonyltrioctyloxycatecholate, nonyltrinonyloxycatecholate, nonyltridecyloxycatecholate, dimethoxynonylcatecholate, diethoxynonylcatecholate, dipropoxynonylcatecholate, dibutoxynonylcatecholate, diipentyloxynonylcatecholate, dihexyloxynonylcatecholate, diheptyloxynonylcatecholate, dioctyloxynonylcatecholate, dinonyloxynonylcatecholate, didecyloxynonylcatecholate, methoxytrinonylcatecholate, ethoxytrinonylcatecholate, propoxytrinonylcatecholate, butoxytrinonylcatecholate, pentyloxytrinonylcatecholate, hexyloxytrinonylcatecholate, heptyloxytrinonylcatecholate, octyloxytrinonylcatecholate, nonyloxytrinonylcatecholate, decyloxytrinonylcatecholate, decylcatecholate, didecylcatecholate,

tridecylcatecholate, tetradecylcatecholate, dichlorodidecylcatecholate, chlorodecylcatecholate, chlorodidecylcatecholate, chlorotridecylcatecholate, dichlorodecylcatecholate, decyltrichlorocatecholate, difluorodidecylcatecholate, fluorodecylcatecholate, fluorodidecylcatecholate, fluorotridecylcatecholate, difluorodecylcatecholate, decyltrifluorocatecholate, dibromodidecylcatecholate, bromodecylcatecholate, bromodidecylcatecholate, bromotridecylcatecholate, dibromodecylcatecholate, decyltribromocatecholate, diiododidecylcatecholate, iododecylcatecholate, iododidecylcatecholate, iodotridecylcatecholate, diiododecylcatecholate, decyltriiodocatecholate, decylnitrocatecholate, didecylnitrocatecholate, tridecylnitrocatecholate, dimethoxydidecylcatecholate, diethoxydidecylcatecholate, didecyldipropoxycatecholate, dibutoxydidecylcatecholate, didecyldipentyloxycatecholate, dihexyloxydidecylcatecholate, diheptyloxydidecylcatecholate, didecyldioctyloxycatecholate, didecyldinonyloxycatecholate, didecyloxydidecylcatecholate, didecylmethoxycatecholate, didecylethoxycatecholate, didecylpropoxycatecholate, butoxydidecylcatecholate, didecylpentyloxycatecholate, didecylhexyloxycatecholate, didecylheptyloxycatecholate, didecyloctyloxycatecholate, didecylnonyloxycatecholate, decyloxydidecylcatecholate, decylmethoxycatecholate, decylethoxycatecholate, decylpropoxycatecholate, butoxydecylcatecholate, decylpentyloxycatecholate, hexyloxydecylcatecholate, heptyloxydecylcatecholate, decyloctyloxycatecholate, decylnonyloxycatecholate, decyloxydecylcatecholate, decyltrimethoxycatecholate, decyltriethoxycatecholate, decyltripropoxycatecholate, decyltributoxycatecholate, decyltripentyloxycatecholate, decyltrihexyloxycatecholate, decyltriheptyloxycatecholate, decyltrioctyloxycatecholate, decyltrinonyloxycatecholate, decyltridecyloxycatecholate, dimethoxydecylcatecholate, diethoxydecylcatecholate, dipropoxydecylcatecholate, dibutoxydecylcatecholate, diipentyloxydecylcatecholate, dihexyloxydecylcatecholate, diheptyloxydecylcatecholate, dioctyloxydecylcatecholate, dinonyloxydecylcatecholate, didecyloxydecylcatecholate, methoxytridecylcatecholate, ethoxytridecylcatecholate, propoxytridecylcatecholate, butoxytridecylcatecholate, pentyloxytridecylcatecholate, hexyloxytridecylcatecholate, heptyloxytridecylcatecholate, octyloxytridecylcatecholate, nonyloxytridecylcatecholate, decyloxytridecylcatecholate, methoxycatecholate,

ethoxycatecholate, propoxycatecholate, butoxymethylcatecholate, pentyloxycatecholate, hexyloxycatecholate, heptyloxycatecholate, octyloxycatecholate, nonyloxycatecholate, decyloxycatecholate, dimethoxycatecholate, diethoxycatecholate, dipropoxycatecholate, dibutoxymethylcatecholate, dipentyloxycatecholate, dihexyloxycatecholate, diheptyloxycatecholate, dioctyloxycatecholate, dinonyloxycatecholate, didecyloxycatecholate, trimethoxycatecholate, triethoxycatecholate, propoxycatecholate, butoxymethylcatecholate, tripentyloxycatecholate, trihexyloxycatecholate, triheptyloxycatecholate, trioctyloxycatecholate, trinonyloxycatecholate, tridecyloxycatecholate, butylethylmethypropylcatecholate, butylethylcatecholate, butylmethylcatecholate, butylpropylcatecholate, ethylmethylcatecholate, ethylpropylcatechlolate, methylpropylcatecholate, dibutyldiethylcatecholate, dibutyldimethylcatecholate, dibutyldipropylcatecholate, diethyldimethylcatecholate, diethyldipropylcatecholate, dimethyldipropylcatecholate, dibutylethylcatecholate, dibutylmethylcatecholate, dibutylpropylcatecholate, diethylmethylcatecholate, diethylpropylcatecholate, diethylbutylcatecholate, dimethylpropylcatecholate, dimethylethylcatecholate, dimethylbutylcatecholate, butylchloroethylcatecholate, butylchloromethylcatecholate, butylchloropropylcatecholate, ethylchloromethylcatecholate, ethylchloropropylcatechlolate, methylchloropropylcatecholate, butyldichloroethylcatecholate, butyldichloromethylcatecholate, butyldichloropropylcatecholate, ethyldichloromethylcatecholate, ethyldichloropropylcatechlolate, methyldichloropropylcatecholate, bromobutylethylcatecholate, bromobutylmethylcatecholate, bromobutylpropylcatecholate, bromoethylmethylcatecholate, bromoethylpropylcatechlolate, bromomethylpropylcatecholate, butyldibromoethylcatecholate, butyldibromomethylcatecholate, butyldibromopropylcatecholate, ethyldibromomethylcatecholate, ethyldibromopropylcatechlolate, methyldibromopropylcatecholate, dibutylcyclohexylcatecholate, dipropylcyclohexylcatecholate, diethylcyclohexylcatecholate, dimethylcyclohexylcatecholate, tributylcyclohexylcatecholate, tripropylcyclohexylcatecholate, triethylcyclohexylcatecholate, trimethylcyclohexylcatecholate,

butylcyclohexylcatecholate, propylcyclohexylcatecholate, ethylcyclohexylcatecholate, methylcyclohexylcatecholate, butylpropylcyclohexylcatecholate, butylethylcyclohexylcatecholate, butylmethylcyclohexylcatecholate, propylethylcyclohexylcatecholate, propylmethylcyclohexylcatecholate, ethylmethylcyclohexylcatecholate, dibutylphenylcatecholate, dipropylphenylcatecholate, diethylphenylcatecholate, dimethylphenylcatecholate, tributylphenylcatecholate, tripropylphenylcatecholate, triethylphenylcatecholate, trimethylphenylcatecholate, butylphenylcatecholate, propylphenylcatecholate, ethylphenylcatecholate, methylphenylcatecholate, butylpropylphenylcatecholate, butylethylphenylcatecholate, butylmethylphenylcatecholate, propylethylphenylcatecholate, propylmethylphenylcatecholate, ethylmethylphenylcatecholate, phenylcatecholate, tetrachlorocatecholate, tetrabromocatecholate, tetrafluorocatecholate, tetraiodocatecholate, trichlorocatecholate, tribromocatecholate, trifluorocatecholate, triiodocatecholate, dichlorocatecholate, dibromocatecholate, difluorocatecholate, diiodocatecholate, chlorocatecholate, bromocatecholate, fluorocatecholate, iodocatecholate, methyldibenzo[1,4]dioxine-2,3-diolate, dimethyldibenzo[1,4]dioxine-2,3-diolate, trimethyldibenzo[1,4]dioxine-2,3-diolate, tetramethyldibenzo[1,4]dioxine-2,3-diolate, pentamethyldibenzo[1,4]dioxine-2,3-diolate, hexamethyldibenzo[1,4]dioxine-2,3-diolate, ethyldibenzo[1,4]dioxine-2,3-diolate, diethyldibenzo[1,4]dioxine-2,3-diolate, triethyldibenzo[1,4]dioxine-2,3-diolate, tetraethyldibenzo[1,4]dioxine-2,3-diolate, pentaethyldibenzo[1,4]dioxine-2,3-diolate, hexaethyldibenzo[1,4]dioxine-2,3-diolate, propyldibenzo[1,4]dioxine-2,3-diolate, dipropyldibenzo[1,4]dioxine-2,3-diolate, tripropyldibenzo[1,4]dioxine-2,3-diolate, tetrapropyldibenzo[1,4]dioxine-2,3-diolate, pentapropyldibenzo[1,4]dioxine-2,3-diolate, hexapropyldibenzo[1,4]dioxine-2,3-diolate, butyldibenzo[1,4]dioxine-2,3-diolate, dibutyldibenzo[1,4]dioxine-2,3-diolate, tributyldibenzo[1,4]dioxine-2,3-diolate, tetrabutyldibenzo[1,4]dioxine-2,3-diolate, pentabutyldibenzo[1,4]dioxine-2,3-diolate, hexabutyldibenzo[1,4]dioxine-2,3-diolate, pentyldibenzo[1,4]dioxine-2,3-diolate, dipentyldibenzo[1,4]dioxine-2,3-diolate, tripentyldibenzo[1,4]dioxine-2,3-diolate, tetrapentyldibenzo[1,4]dioxine-2,3-diolate, pentapentyldibenzo[1,4]dioxine-2,3-diolate, hexapentyldibenzo[1,4]dioxine-2,3-diolate, hexyldibenzo[1,4]dioxine-2,3-diolate, dihexyldibenzo[1,4]dioxine-2,3-diolate, trihexyldibenzo[1,4]dioxine-2,3-diolate, tetrahexyldibenzo[1,4]dioxine-2,3-

diolate, pentahexyldibenzo[1,4]dioxine-2,3-diolate, hexahexyldibenzo[1,4]dioxine-2,3-diolate, heptyldibenzo[1,4]dioxine-2,3-diolate, diheptyldibenzo[1,4]dioxine-2,3-diolate, triheptyldibenzo[1,4]dioxine-2,3-diolate, tetraheptyldibenzo[1,4]dioxine-2,3-diolate, pentaheptyldibenzo[1,4]dioxine-2,3-diolate, hexaheptyldibenzo[1,4]dioxine-2,3-diolate, octyldibenzo[1,4]dioxine-2,3-diolate, dioctyldibenzo[1,4]dioxine-2,3-diolate, trioctyldibenzo[1,4]dioxine-2,3-diolate, tetraoctyldibenzo[1,4]dioxine-2,3-diolate, pentaoctyldibenzo[1,4]dioxine-2,3-diolate, hexaoctyldibenzo[1,4]dioxine-2,3-diolate, nonyldibenzo[1,4]dioxine-2,3-diolate, dinonyldibenzo[1,4]dioxine-2,3-diolate, trinonyldibenzo[1,4]dioxine-2,3-diolate, tetranonyldibenzo[1,4]dioxine-2,3-diolate, pentanonyldibenzo[1,4]dioxine-2,3-diolate, hexanonyldibenzo[1,4]dioxine-2,3-diolate, decyldibenzo[1,4]dioxine-2,3-diolate, didecyldibenzo[1,4]dioxine-2,3-diolate, tridecyldibenzo[1,4]dioxine-2,3-diolate, tetradecyldibenzo[1,4]dioxine-2,3-diolate, pentadecyldibenzo[1,4]dioxine-2,3-diolate, hexadecyldibenzo[1,4]dioxine-2,3-diolate, chlorodibenzo[1,4]dioxine-2,3-diolate, dichlorodibenzo[1,4]dioxine-2,3-diolate, trichlorodibenzo[1,4]dioxine-2,3-diolate, tetrachlorodibenzo[1,4]dioxine-2,3-diolate, pentachlorodibenzo[1,4]dioxine-2,3-diolate, hexachlorodibenzo[1,4]dioxine-2,3-diolate, bromodibenzo[1,4]dioxine-2,3-diolate, dibromodibenzo[1,4]dioxine-2,3-diolate, tribromodibenzo[1,4]dioxine-2,3-diolate, tetrabromodibenzo[1,4]dioxine-2,3-diolate, pentabromodibenzo[1,4]dioxine-2,3-diolate, hexabromodibenzo[1,4]dioxine-2,3-diolate, bromomethyldibenzo[1,4]dioxine-2,3-diolate, bromodimethyldibenzo[1,4]dioxine-2,3-diolate, bromomethyltribenzo[1,4]dioxine-2,3-diolate, bromotetramethyldibenzo[1,4]dioxine-2,3-diolate, bromopentamethyldibenzo[1,4]dioxine-2,3-diolate, dibromomethyldibenzo[1,4]dioxine-2,3-diolate, dibromodimethyldibenzo[1,4]dioxine-2,3-diolate, dibromotrimethyldibenzo[1,4]dioxine-2,3-diolate, dibromotetramethyldibenzo[1,4]dioxine-2,3-diolate, tribromomethyldibenzo[1,4]dioxine-2,3-diolate, tribromodimethyldibenzo[1,4]dioxine-2,3-diolate, tribromotrimethyldibenzo[1,4]dioxine-2,3-diolate, tetrabromomethyldibenzo[1,4]dioxine-2,3-diolate, tetrabromodimethyldibenzo[1,4]dioxine-2,3-diolate, pentabromomethyldibenzo[1,4]dioxine-2,3-diolate, chloromethyldibenzo[1,4]dioxine-

2,3-diolate, chlorodimethyldibenzo[1,4]dioxine-2,3-diolate, chloromethyltribenzo[1,4]dioxine-2,3-diolate, chlorotetramethyldibenzo[1,4]dioxine-2,3-diolate, chloropentamethyldibenzo[1,4]dioxine-2,3-diolate, dichloromethyldibenzo[1,4]dioxine-2,3-diolate, dichlorodimethyldibenzo[1,4]dioxine-2,3-diolate, dichlorotrimethyldibenzo[1,4]dioxine-2,3-diolate, dichlorotetramethyldibenzo[1,4]dioxine-2,3-diolate, trichloromethyldibenzo[1,4]dioxine-2,3-diolate, trichlorodimethyldibenzo[1,4]dioxine-2,3-diolate, trichlorotrimethyldibenzo[1,4]dioxine-2,3-diolate, tetrachloromethyldibenzo[1,4]dioxine-2,3-diolate, tetrachlorodimethyldibenzo[1,4]dioxine-2,3-diolate, pentachloromethyldibenzo[1,4]dioxine-2,3-diolate, bromoethyldibenzo[1,4]dioxine-2,3-diolate, bromodiethyldibenzo[1,4]dioxine-2,3-diolate, bromoethyltribenzo[1,4]dioxine-2,3-diolate, bromotetraethyldibenzo[1,4]dioxine-2,3-diolate, bromopentaethyldibenzo[1,4]dioxine-2,3-diolate, dibromoethyldibenzo[1,4]dioxine-2,3-diolate, dibromodiethyldibenzo[1,4]dioxine-2,3-diolate, dibromotriethyldibenzo[1,4]dioxine-2,3-diolate, dibromotetraethyldibenzo[1,4]dioxine-2,3-diolate, tribromoethyldibenzo[1,4]dioxine-2,3-diolate, tribromodiethyldibenzo[1,4]dioxine-2,3-diolate, tribromotriethyldibenzo[1,4]dioxine-2,3-diolate, tetrabromoethyldibenzo[1,4]dioxine-2,3-diolate, tetrabromodiethyldibenzo[1,4]dioxine-2,3-diolate, pentabromoethyldibenzo[1,4]dioxine-2,3-diolate, chloroethyldibenzo[1,4]dioxine-2,3-diolate, chlorodiethyldibenzo[1,4]dioxine-2,3-diolate, chloroethyltribenzo[1,4]dioxine-2,3-diolate, chlorotetraethyldibenzo[1,4]dioxine-2,3-diolate, chloropentaethyldibenzo[1,4]dioxine-2,3-diolate, dichloroethyldibenzo[1,4]dioxine-2,3-diolate, dichlorodiethyldibenzo[1,4]dioxine-2,3-diolate, dichlorotriethyldibenzo[1,4]dioxine-2,3-diolate, dichlorotetraethyldibenzo[1,4]dioxine-2,3-diolate, trichloroethyldibenzo[1,4]dioxine-2,3-diolate, trichlorodiethyldibenzo[1,4]dioxine-2,3-diolate, trichlorotriethyldibenzo[1,4]dioxine-2,3-diolate, tetrachloroethyldibenzo[1,4]dioxine-2,3-diolate, tetrachlorodiethyldibenzo[1,4]dioxine-2,3-diolate, pentachloroethyldibenzo[1,4]dioxine-2,3-diolate, bromopropyldibenzo[1,4]dioxine-

2,3-diolate, bromodipropyldibenzo[1,4]dioxine-2,3-diolate, bromopropyltribenzo[1,4]dioxine-2,3-diolate, bromotetrapropyldibenzo[1,4]dioxine-2,3-diolate, bromopentapropyldibenzo[1,4]dioxine-2,3-diolate, dibromopropyldibenzo[1,4]dioxine-2,3-diolate, dibromodipropyldibenzo[1,4]dioxine-2,3-diolate, dibromotripropyldibenzo[1,4]dioxine-2,3-diolate, dibromotetrapropyldibenzo[1,4]dioxine-2,3-diolate, tribromopropyldibenzo[1,4]dioxine-2,3-diolate, tribromodipropyldibenzo[1,4]dioxine-2,3-diolate, tribromotripropyldibenzo[1,4]dioxine-2,3-diolate, tetrabromopropyldibenzo[1,4]dioxine-2,3-diolate, tetrabromodipropyldibenzo[1,4]dioxine-2,3-diolate, pentabromopropyldibenzo[1,4]dioxine-2,3-diolate, chloropropyldibenzo[1,4]dioxine-2,3-diolate, chlorodipropyldibenzo[1,4]dioxine-2,3-diolate, chloropropyltribenzo[1,4]dioxine-2,3-diolate, chlorotetrapropyldibenzo[1,4]dioxine-2,3-diolate, chloropentapropyldibenzo[1,4]dioxine-2,3-diolate, dichloropropyldibenzo[1,4]dioxine-2,3-diolate, dichlorodipropyldibenzo[1,4]dioxine-2,3-diolate, dichlorotripropyldibenzo[1,4]dioxine-2,3-diolate, dichlorotetrapropyldibenzo[1,4]dioxine-2,3-diolate, trichloropropyldibenzo[1,4]dioxine-2,3-diolate, trichlorodipropyldibenzo[1,4]dioxine-2,3-diolate, trichlorotripropyldibenzo[1,4]dioxine-2,3-diolate, tetrachloropropyldibenzo[1,4]dioxine-2,3-diolate, tetrachlorodipropyldibenzo[1,4]dioxine-2,3-diolate, pentachloropropyldibenzo[1,4]dioxine-2,3-diolate, bromobutyldibenzo[1,4]dioxine-2,3-diolate, bromodibutyldibenzo[1,4]dioxine-2,3-diolate, bromobutyltribenzo[1,4]dioxine-2,3-diolate, bromotetrabutyldibenzo[1,4]dioxine-2,3-diolate, bromopentabutyldibenzo[1,4]dioxine-2,3-diolate, dibromobutyldibenzo[1,4]dioxine-2,3-diolate, dibromodibutyldibenzo[1,4]dioxine-2,3-diolate, dibromotributyldibenzo[1,4]dioxine-2,3-diolate, dibromotetrabutyldibenzo[1,4]dioxine-2,3-diolate, tribromobutyldibenzo[1,4]dioxine-2,3-diolate, tribromodibutyldibenzo[1,4]dioxine-2,3-diolate, tribromotributyldibenzo[1,4]dioxine-2,3-diolate, tetrabromobutyldibenzo[1,4]dioxine-2,3-diolate, tetrabromodibutyldibenzo[1,4]dioxine-2,3-diolate, pentabromobutyldibenzo[1,4]dioxine-2,3-diolate, chlorobutyldibenzo[1,4]dioxine-

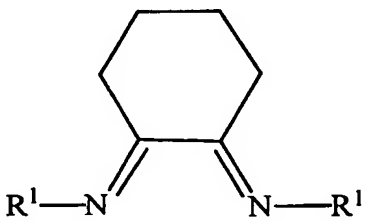
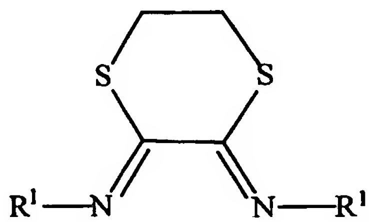
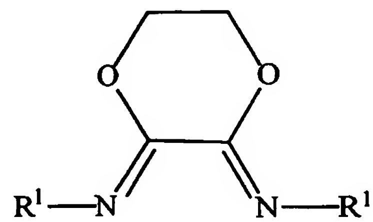
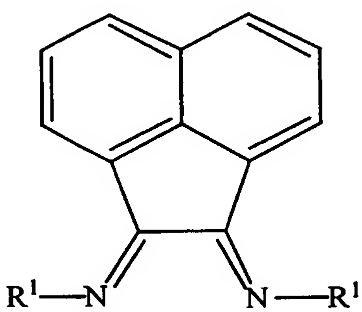
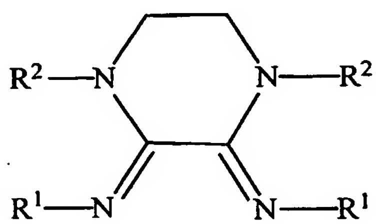
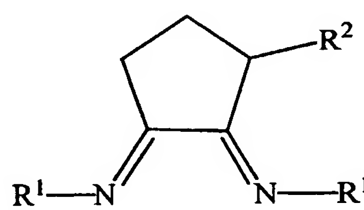
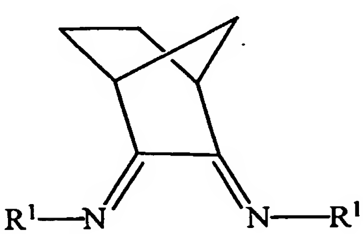
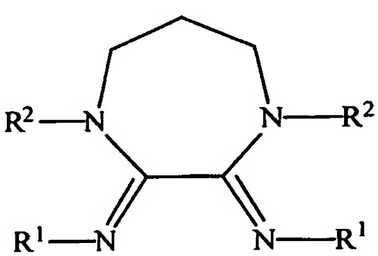
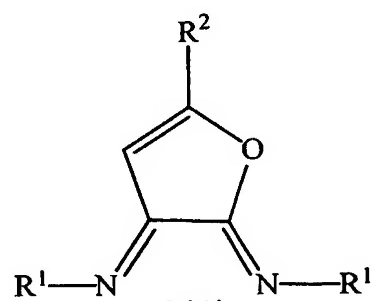
2,3-diolate, chlorodibutyldibenzo[1,4]dioxine-2,3-diolate, chlorobutyltribenzo[1,4]dioxine-2,3-diolate, chlorotetrabutyldibenzo[1,4]dioxine-2,3-diolate, chloropentabutyldibenzo[1,4]dioxine-2,3-diolate, dichlorobutyldibenzo[1,4]dioxine-2,3-diolate, dichlorodibutyldibenzo[1,4]dioxine-2,3-diolate, dichlorotributyldibenzo[1,4]dioxine-2,3-diolate, dichlorotetrabutyldibenzo[1,4]dioxine-2,3-diolate, trichlorobutyldibenzo[1,4]dioxine-2,3-diolate, trichlorodibutyldibenzo[1,4]dioxine-2,3-diolate, trichlorotributyldibenzo[1,4]dioxine-2,3-diolate, tetrachlorobutyldibenzo[1,4]dioxine-2,3-diolate, tetrachlorodibutyldibenzo[1,4]dioxine-2,3-diolate, pentachlorobutyldibenzo[1,4]dioxine-2,3-diolate, naphthalene-2,3-diolate, and phenanthrene-9,10-diolate.

Most preferred catecholate ligands, X, are selected from the group THETA-CATACHOLATES which is defined to be: 3,6-di-*tert*-butylcatecholate, 3,6-di-*tert*-butyl-4-chlorocatecholate, 3,6-di-*tert*-butyl-4,5-dichlorocatecholate, 3,6-di-*tert*-butyl-4-bromocatecholate, 3,6-di-*tert*-butyl-4,5-dibromocatecholate, 3,6-di-*tert*-butyl-4-fluorocatecholate, 3,6-di-*tert*-butyl-4,5-difluorocatecholate, 3,6-di-*tert*-butyl-4-methoxycatecholate, 3,6-di-*tert*-butyl-4,5-dimethoxycatecholate, 3,6-di-*tert*-butyl-4-ethoxycatecholate, 3,6-di-*tert*-butyl-4,5-diethoxycatecholate, 3,6-di-*tert*-butyl-4-propoxycatecholate, 3,6-di-*tert*-butyl-4,5-dipropoxycatecholate, 3,6-di-*tert*-butyl-4-butoxycatecholate, 3,6-di-*tert*-butyl-4,5-dibutoxycatecholate, 3,6-di-*tert*-butyl-4-iso-propylcatecholate, 3,6-di-tert-butyl-4,5-di-isopropylcatecholate, 3,6-di-*tert*-butyl-4-cyclohexylcatecholate, 3,5-di-*tert*-butylcatecholate, 3,5-di-*tert*-butyl-6-chlorocatecholate, 3,5-di-*tert*-butyl-6-bromocatecholate, 3,5-di-*tert*-butyl-6-fluorocatecholate, 3,5-di-*tert*-butyl-6-nitrocatecholate, 3,4,6-tri-isopropylcatecholate, 3,4,5,6-tetra-isopropylcatecholate, 3,6-di-isopropylcatecholate, 1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate, 1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate, 1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate, 3,6-di-*n*-butylcatecholate, 3,6-di-*n*-butyl-4-chlorocatecholate, 3,6-di-*n*-butyl-4,5-dichlorocatecholate,3,6-di-*n*-butyl-4-bromocatecholate, 3,6-di-*n*-butyl-4,5-dibromocatecholate, 3,6-di-*n*-butyl-4-fluorocatecholate,3,6-di-*n*-butyl-4,5-difluorocatecholate, 3,6-di-*n*-butyl-4-methoxycatecholate,3,6-di-*n*-butyl-4,5-dimethoxycatecholate, 3,6-di-*n*-butyl-4-ethoxycatecholate, 3,6-di-*n*-butyl-4,5-diethoxycatecholate, 3,6-di-*n*-butyl-4-propoxycatecholate, 3,6-di-*n*-butyl-4,5-

dipropoxycatecholate, 3,6-di-*n*-butyl-4-butoxycatecholate, 3,6-di-*n*-butyl-4,5-dibutoxycatecholate, 3,6-di-*n*-butyl-4-isopropylcatecholate, 3,6-di-*n*-butyl-4,5-di-isopropylcatecholate, 3,6-di-*n*-butyl-4-cyclohexylcatecholate, 3,5-di-*n*-butylcatecholate, 3,5-di-*n*-butyl-6-chlorocatecholate, 3,5-di-*n*-butyl-6-bromocatecholate, 3,5-di-*n*-butyl-6-fluorocatecholate, 3,5-di-*n*-butyl-6-nitrocatecholate, 3,6-di-*iso*-butylcatecholate, 3,6-di-*iso*-butyl-4-chlorocatecholate, 3,6-di-*iso*-butyl-4,5-dichlorocatecholate,3,6-di-*iso*-butyl-4-bromocatecholate, 3,6-di-*iso*-butyl-4,5-dibromocatecholate, 3,6-di-*iso*-butyl-4-fluorocatecholate, 3,6-di-*iso*-butyl-4,5-difluorocatecholate, 3,6-di-*iso*-butyl-4-methoxycatecholate, 3,6-di-*iso*-butyl-4,5-dimethoxycatecholate, 3,6-di-*iso*-butyl-4-ethoxycatecholate, 3,6-di-*iso*-butyl-4,5-diethoxycatecholate, 3,6-di-*iso*-butyl-4-propoxycatecholate, 3,6-di-*iso*-butyl-4,5-dipropoxycatecholate, 3,6-di-*iso*-butyl-4-butoxycatecholate, 3,6-di-*iso*-butyl-4,5-dibutoxycatecholate, 3,6-di-*iso*-butyl-4-isopropylcatecholate, 3,6-di-*iso*-butyl-4,5-di-isopropylcatecholate, 3,6-di-*iso*-butyl-4-cyclohexylcatecholate, 3,5-di-*iso*-butylcatecholate, 3,5-di-*iso*-butyl-6-chlorocatecholate, 3,5-di-*iso*-butyl-6-bromocatecholate, 3,5-di-*iso*-butyl-6-fluorocatecholate, 3,5-di-*iso*-butyl-6-nitrocatecholate, 3,4,6-tri-*n*-propylcatecholate, 3,6-di-isopropyl-4-chlorocatecholate, 3,6-di-isopropyl-4,5-dichlorocatecholate, 3,6-di-isopropyl-4-bromocatecholate, 3,6-di-isopropyl-4,5-dibromocatecholate, 3,6-di-isopropyl-4-fluorocatecholate, 3,6-di-isopropyl-4,5-difluorocatecholate, 3,6-di-isopropyl-4-methyoxycatecholate, 3,6-di-isopropyl-4,5-dimethoxycatecholate, 3,6-di-isopropyl-4-ethyoxycatecholate, 3,6-di-isopropyl-4,5-diethoxycatecholate, 3,6-di-isopropyl-4-propoxycatecholate, 3,6-di-isopropyl-4,5-dipropoxycatecholate, 3,6-di-isopropyl-4-butoxycatecholate, 3,6-di-isopropyl-4,5-dibutoxycatecholate, 3,6-di-isopropyl-4-cyclohexylcatecholate, 3,6-dimethyl-4-chlorocatecholate, 3,6-dimethyl-4,5-dichlorocatecholate, 3,6-diisopropyl-4-bromocatecholate, 3,6-dimethyl-4,5-dibromocatecholate, 3,6-dimethyl-4-fluorocatecholate, 3,6-dimethyl-4,5-difluorocatecholate, 3,6-dimethyl-4-methyoxycatecholate, 3,6-dimethyl-4,5-dimethoxycatecholate, 3,6-dimethyl-4-ethyoxycatecholate, 3,6-dimethyl-4,5-diethoxycatecholate, 3,6-dimethyl-4-propoxycatecholate, 3,6-dimethyl-4,5-dipropoxycatecholate, 3,6-dimethyl-4-butoxycatecholate, 3,6-dimethyl-4,5-dibutoxycatecholate, 3,5-di-isopropylcatecholate, 3,6-di-*n*-propylcatecholate, 3,5-di-*n*-propylcatecholate, 3,6-dimethylcatecholate, 3,5-

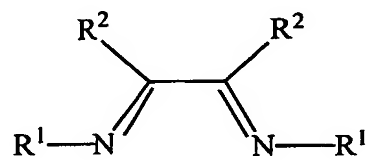
dimethylcatecholate, 4-methylcatecholate, naphthalene-2,3-diolate, and phenanthrene-9,10-diolate.

In some embodiments of the invention, the ligand structure, L*1, may be represented by the following structures:

 L*1a	 L*1b	 L*1c
 L*1d	 L*1e	 L*1f
 L*1g	 L*1h	 L*1i

where R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$).

In some embodiments of the invention, the catalyst precursor is represented by the formula L*1-MX, where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably Fe, Co, Ni, or Pd, and even more preferably Ni or Pd; X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality; and L*1 is ligand represented by the general formula, L*1 ,

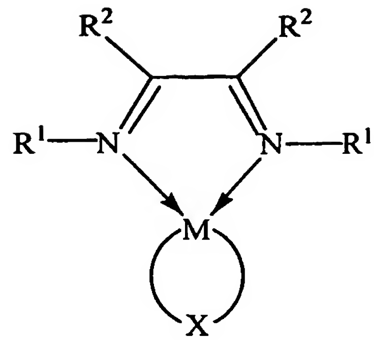


where N is nitrogen, R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; and R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$), and optionally both R^2 may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

Preferred L*1 ligands are those with R^2, independently, being hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl. Also preferred is when L*1 takes on the formulas represented by L*1a through L*1i. Most preferred are R^2, independently, being hydrogen, methyl, ethyl, propyl, or phenyl, and where L*1 is of structures L*1d, L*1b and L*1e.

Preferred R^1 substituents are, independently, of formulae S1 through S31, with S1, S7 and S16 being most preferred.

In another preferred embodiment catalysts precursors are represented by the formula:



TMC Formula 1:

where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Ni or Pd;

N is nitrogen;

R^1 is, independently, a bulky hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent, and is preferably described by formulae S1 through S31, and most preferably described by formulae S1, S7 and S16;

R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy; and optionally both R^2 may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

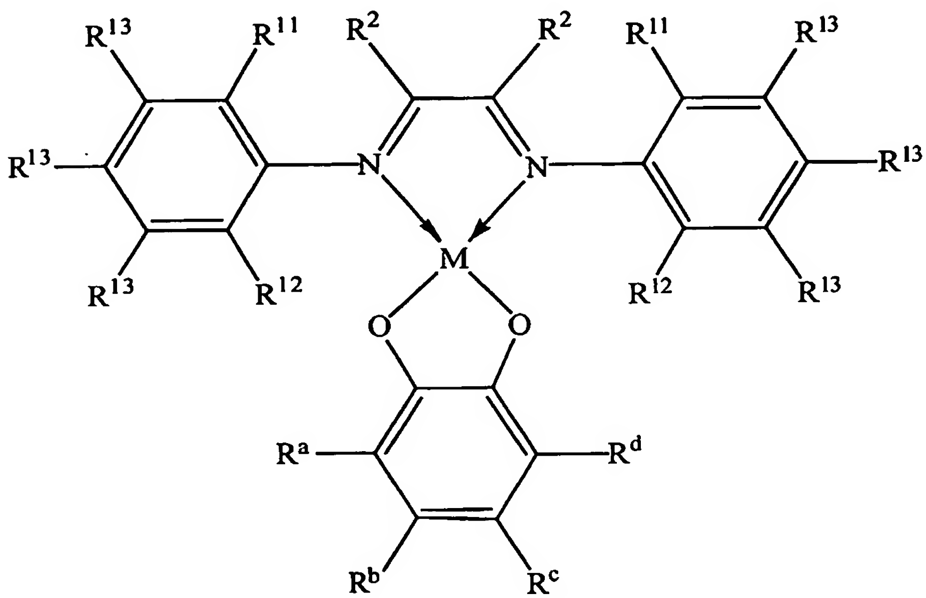
X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality.

Preferred R^2 are, independently, hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl, with hydrogen, methyl, ethyl, propyl, or phenyl being most preferred; or both R^2 join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure, with acenaphthylene, [1,4]-dithiane, piperazine, 1,4-dimethylpiperazine, bicyclo[2.2.1]heptane, 1,4-dimethyl[1,4]diazepane, methylcyclopentane, methyltetrahydrofuran, and

methyldihydrofuran being the preferred ring structures, and with acenaphthylene being the most preferred ring structure.

More preferably, the catalyst precurosr is represented by the following structure:

TMC Formula 2:



where M is a Group 8, 9, 10, or 11 transition metal, preferably, Fe, Co, Ni, or Pd, and even more preferably Ni or Pd;

N is nitrogen;

O is oxygen;

R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, and optionally both R^2 may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure;

R^{11}, R^{12}, and R^{13} are, independently, hydrogen, hydrocarbyl radicals, substituted hydrocarbyl radicals, halocarbyl radicals, substituted halocarbyl radicals, silylcarbyl

radicals or polar radicals, and optionally, R^{11}, R^{12}, and/or two or more R^{13} on adjacent atoms may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

R^a, R^b, R^c and R^d are, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl, and optionally two or more adjacent R^a, R^b, R^c and/or R^d may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

Some invention embodiments, independently, select R^a, R^b, R^c and R^d from hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy, phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group.

Some invention embodiments prefer that at least one R^a, R^b, R^c or R^d is not hydrogen.

Some invention embodiments select two or more adjacent R^a, R^b, R^c and/or R^d to join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent. Preferred structures of this type are represented by formulae X1 through X52.

Some invention embodiments, independently, select R^{10}, R^{11}, R^{12}, and R^{13} from hydrogen or hydrocarbyl radicals including methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl; from halocarbyls and all isomers of halocarbyls including perfluoropropyl, perfluorobutyl, perfluoropentyl, perfluorohexyl, perfluoroheptyl, perfluorooctyl, perfluorononyl, perfluorodecyl, perfluoroundecyl, perfluorododecyl, perfluorotridecyl, perfluorotetradecyl, perfluoropentadecyl, perfluorohexadecyl, perfluoroheptadecyl, perfluorooctadecyl, perfluorononadecyl, perfluoroeicosyl, perfluoroheneicosyl, perfluorodocosyl, perfluorotricosyl, perfluorotetracosyl, perfluoropentacosyl, perfluorohexacosyl, perfluoroheptacosyl, perfluorooctacosyl, perfluorononacosyl, perfluorotriacontyl, perfluorobutenyl, perfluorobutynyl, fluoropropyl, fluorobutyl, fluoropentyl, fluorohexyl, fluoroheptyl, fluorooctyl, fluorononyl, fluorodecyl, fluoroundecyl, fluorododecyl, fluorotridecyl, fluorotetradecyl, fluoropentadecyl, fluorohexadecyl, fluoroheptadecyl, fluorooctadecyl, fluorononadecyl, fluoroeicosyl, fluoroheneicosyl, fluorodocosyl, fluorotricosyl, fluorotetracosyl, fluoropentacosyl, fluorohexacosyl, fluoroheptacosyl, fluorooctacosyl, fluorononacosyl, fluorotriacontyl, difluorobutyl, trifluorobutyl, tetrafluorobutyl, pentafluorobutyl, hexafluorobutyl, heptafluorobutyl, octafluorobutyl; from substituted hydrocarbyl radicals and all

isomers of substituted hydrocarbyl radicals including methoxypropyl, methoxybutyl, methoxypentyl, methoxyhexyl, methoxyheptyl, methoxyoctyl, methoxynonyl, methoxydecyl, methoxyundecyl, methoxydodecyl, methoxytridecyl, methoxytetradecyl, methoxypentadecyl, methoxyhexadecyl, methoxyheptadecyl, methoxyoctadecyl, methoxynonadecyl, methoxyeicosyl, methoxyheneicosyl, methoxydocosyl, methoxytricosyl, methoxytetracosyl, methoxypentacosyl, methoxyhexacosyl, methoxyheptacosyl, methoxyoctacosyl, methoxynonacosyl, methoxytriacontyl, butoxypropyl, butoxybutyl, butoxypentyl, butoxyhexyl, butoxyheptyl, butoxyoctyl, butoxynonyl, butoxydecyl, butoxyundecyl, butoxydodecyl, butoxytridecyl, butoxytetradecyl, butoxypentadecyl, butoxyhexadecyl, butoxyheptadecyl, butoxyoctadecyl, butoxynonadecyl, butoxyeicosyl, butoxyheneicosyl, butoxydocosyl, butoxytricosyl, butoxytetracosyl, butoxypentacosyl, butoxyhexacosyl, butoxyheptacosyl, butoxyoctacosyl, butoxynonacosyl, butoxytriacontyl, dimethylaminopropyl, dimethylaminobutyl, dimethylaminopentyl, dimethylaminohexyl, dimethylaminoheptyl, dimethylaminooctyl, dimethylaminononyl, dimethylaminodecyl, dimethylaminoundecyl, dimethylaminododecyl, dimethylaminotridecyl, dimethylaminotetradecyl, dimethylaminopentadecyl, dimethylaminohexadecyl, dimethylaminoheptadecyl, dimethylaminooctadecyl, dimethylaminononadecyl, dimethylaminoeicosyl, dimethylaminoheneicosyl, dimethylaminodocosyl, dimethylaminotricosyl, dimethylaminotetracosyl, dimethylaminopentacosyl, dimethylaminohexacosyl, dimethylaminoheptacosyl, dimethylaminooctacosyl, dimethylaminononacosyl, dimethylaminotriacontyl, trimethylsilylpropyl, trimethylsilylbutyl, trimethylsilylpentyl, trimethylsilylhexyl, trimethylsilylheptyl, trimethylsilyloctyl, trimethylsilylnonyl, trimethylsilyldecyl, trimethylsilylundecyl, trimethylsilyldodecyl, trimethylsilyltridecyl, trimethylsilyltetradecyl, trimethylsilylpentadecyl, trimethylsilylhexadecyl, trimethylsilylheptadecyl, trimethylsilyloctadecyl, trimethylsilylnonadecyl, trimethylsilyleicosyl, trimethylsilylheneicosyl, trimethylsilyldocosyl, trimethylsilyltricosyl, trimethylsilyltetracosyl, trimethylsilylpentacosyl, trimethylsilylhexacosyl, trimethylsilylheptacosyl, trimethylsilyloctacosyl, trimethylsilylnonacosyl, trimethylsilyltriacontyl and the like; from phenyl, and all isomers of hydrocarbyl substituted phenyl including methylphenyl, dimethylphenyl, trimethylphenyl,

tetramethylphenyl, pentamethylphenyl ethylphenyl, diethylphenyl, triethylphenyl, tetraethylphenyl, pentaethylphenyl, propylphenyl, dipropylphenyl, tripropylphenyl, tetrapropylphenyl, pentapropylphenyl butylphenyl, dibutylphenyl, tributylphenyl, tetrabutylphenyl, pentabutylphenyl, hexylphenyl, dihexylphenyl, trihexylphenyl, tetrahexylphenyl, pentahexylphenyl, dimethylethylphenyl, dimethylpropylphenyl, dimethylbutylphenyl, dimethylpentylphenyl, dimethylhexylphenyl, diethylmethylphenyl, diethylpropylphenyl, diethylbutylphenyl, diethylpentylphenyl, diethylhexylphenyl, dipropylmethylphenyl, dipropylethylphenyl, dipropylbutylphenyl, dipropylpentylphenyl, dipropylhexylphenyl, dibutylmethylphenyl, dibutylethylphenyl, dibutylpropylphenyl, dibutylpentylphenyl, dibutylhexylphenyl, methylethylphenyl, methylpropylphenyl, methylbutylphenyl, methylpentylphenyl, methylhexylphenyl, ethylpropylphenyl, ethylbutylphenyl, ethylpentylphenyl, ethylhexylphenyl, propylbutylphenyl, propylpentylphenyl, propylhexylphenyl, butylpentylphenyl, butylhexylphenyl, trimethylsilylphenyl, trimethylgermylphenyl, trifluoromethylphenyl, bis(triflouromethyl)phenyl and the like; from all isomers of halo substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halophenyl, dihalophenyl, trihalophenyl, tetrahalophenyl, and pentahalophenyl; from all isomers of halo substituted hydrocarbyl substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halomethylphenyl, dihalomethylphenyl, trihalomethylphenyl, tetrahalomethylphenyl, haloethlyphenyl, dihaloethylphenyl, trihaloethylphenyl, tetrahaloethylphenyl, halopropylphenyl, dihalopropylphenyl, trihalopropylphenyl, tetrahalopropylphenyl, halobutylphenyl, dihalobutylphenyl, trihalobutylphenyl, tetrahalobutylphenyl, dihalodimethylphenyl, dihalo(trifluoromethyl)phenyl and the like; from all isomers of benzyl, and all isomers of hydrocarbyl substituted benzyl including methylbenzyl, dimethylbenzyl, trimethylbenzyl, tetramethylbenzyl, pentamethylbenzyl ethylbenzyl, diethylbenzyl, triethylbenzyl, tetraethylbenzyl, pentaethylbenzyl, propylbenzyl, dipropylbenzyl, tripropylbenzyl, tetrapropylbenzyl, pentapropylbenzyl butylbenzyl, dibutylbenzyl, tributylbenzyl, tetrabutylbenzyl, pentabutylbenzyl, hexylbenzyl, dihexylbenzyl, trihexylbenzyl, tetrahexylbenzyl, pentahexylbenzyl, dimethylethylbenzyl, dimethylpropylbenzyl, dimethylbutylbenzyl, dimethylpentylbenzyl, dimethylhexylbenzyl, diethylmethylbenzyl, diethylpropylbenzyl, diethylbutylbenzyl, diethylpentylbenzyl, diethylhexylbenzyl,

dipropylmethylbenzyl, dipropylethylbenzyl, dipropylbutylbenzyl, dipropylpentylbenzyl, dipropylhexylbenzyl, dibutylmethylbenzyl, dibutylethylbenzyl, dibutylpropylbenzyl, dibutylpentylbenzyl, dibutylhexylbenzyl, methylethylbenzyl, methylpropylbenzyl, methylbutylbenzyl, methylpentylbenzyl, methylhexylbenzyl, ethylpropylbenzyl, ethylbutylbenzyl, ethylpentylbenzyl, ethylhexylbenzyl, propylbutylbenzyl, propylpentylbenzyl, propylhexylbenzyl, butylpentylbenzyl, butylhexylbenzyl, trimethylsilylbenzyl, bis(trimethylsilyl)benzyl, trimethylgermylbenzyl, diphenylmethyl and the like; from trihydrocarbyl-silyl, –germyls, -stannyls and -plumbyls including trimethylsilyl, trimethylgermyl, trimethylstannyl, trimethylplumbyl, triethylsilyl, triethylgermyl, dimethylethylsilyl, dimethylethylgermyl, diethylmethylsilyl, diethylmethylgermyl, triphenylsilyl, triphenylgermyl, and all isomers of tripropylsilyl, tripropylgermyl, tributylsilyl, tributylgermyl, tris(trifluormethyl)silyl, bis(perfluoromethyl)methylsilyl, and the like; from all isomers and hydrocarbyl substituted isomers of polycyclic areneyls including pyrenyl, aceanthrylenyl, acenaphthylene, acephenanthrylenyl, azulenyl biphenylenyl, chrysenyl, coronenyl, fluoranthenyl, fluorenyl, heptacenyl, heptalenyl, heptaphenyl, hexacenyl, hexaphenyl, *as*-indacenyl, *s*-indecenyl, indenyl, ovalenyl, pentacenyl, pentalenyl, pentaphenyl, perylenyl, phenalenyl, phenanthrenyl, picenyl, pleiadenyl, pyranhrenyl, rubicenyl, naphthacenyl, tetraphenylenyl, trinaphthylenyl, triphenylenyl, hexahelicenyl, naphthyl, anthracenyl, dibenza[*a,b*]anthracenyl, indanyl, acenaphthenyl, cholanthrenyl, aceanthrenyl, acephenanthrenyl, 1,2,3,4-tetrahydronapthalene, fullerenyl, and the like; from all isomers and hydrocarbyl substituted isomers of alicyclic monocyclic and polycyclic hydrocarbon rings including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, and cyclododecyl, dimethylcyclohexyl, norbornyl, norbornenyl, adamantyl, cubanyl, prismanyl, spiro[4,5]decanyl, and the like; from all isomers and hydrocarbyl substituted isomers of ring assemblies including biphenyl, bicyclopentyl, terphenyl, quatercyclohexanyl, binaphthyl, binorbornyl, phenyl-terphenyl, and the like; from all isomers and hydrocarbyl substituted isomers of bridged monocyclic and polycyclic arenyls including 1,1-diphenylmethano, 1,1-dinapthyletheno, and the like; from all isomers of heterocycles and hydrocarbyl substituted heterocycles including acridarsinyl, acridinyl, acridophosphinyl, 1*H*-acrindolinyl, anthrazinyl, anthyridinyl, arsanthridinyl,

arsindolyl, arsindolizinyl, arsinolinyl, arsinolizinyl, benzofuranyl, carbazolyl, β-carbolinyl, chromenyl, thiochromenyl, cinnolinyl, furanyl, imidazolyl, indazolyl, indolyl, indolizinyl, isoarsindolyl, isoarsinolinyl, isobenzofuranyl, isochromenyl, isothiochromenyl, isoindolyl, isophosphindolyl, isophosphinolinyl, isoquinolinyl, isothiazolyl, isoxazolyl, naphthyridinyl, oxazolyl, perimidinyl, phenanthrazinyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phosphanthridinyl, phosphindolyl, phosphindolizinyl, phosphinolizinyl, phthalazinyl, pteridinyl, phthaloperinyl, purinyl, pyranyl, thiopyranal, pyrazinyl, pyrazolyl, pyridazinyl, pyridinyl, pyrindinyl, pyrimidinyl, pyrrolyl, pyrrolizinyl, quinazolinyl, quindolinyl, 1*H*-quinindolinyl, quinolinyl, quinolizinyl, quinoxalinyl, selenophenyl, thebenidinyl, thiazolyl, thiophenyl, triphenodioxazinyl, triphenodithiazinyl, xanthenyl, chromanyl, thiochromanyl, imidazolidinyl, indolinyl, isochromanyl, isothiochromanyl, isoindolinyl, morpholinyl, piperazinyl, piperidinyl, pyrozolidinyl, pyrrolidinyl, quinuclidinyl, dimethylacridarsinyl, dimethylacridinyl, dimethylacridophosphinyl, dimethyl-1*H*-acrindolinyl, dimethylanthrazinyl, dimethylanthyridinyl, dimethylarsanthridinyl, dimethylarsindolyl, dimethylarsindolizinyl, dimethylarsinolinyl, dimethylarsinolizinyl, dibutylbenzofuranyl, dibutylcarbazolyl, dibutyl-β-carbolinyl, dibutylchromenyl, dibutylthiochromenyl, butylcinnolinyl, dibutylfuranyl, dimethylimidazolyl, dimethylindazolyl, dipropylindolyl, dipropylindolizinyl, dimethylisoarsindolyl, methylisoarsinolinyl, dimethylisobenzofuranyl, diphenylisochromenyl, dibutylisothiochromenyl, phenylisoindolyl, butylisophosphindolyl, dibutylisophosphinolinyl, dimethylisoquinolinyl, methylisothiazolyl, butylisoxazolyl, butylnaphthyridinyl, dimethyloxazolyl, methylphenylperimidinyl, tetrabutylphenanthrazinyl, propylphenanthridinyl, dibutylphenanthrolinyl, tetramethylphenazinyl, butylphosphanthridinyl, phenylphosphindolyl, dimethylphosphindolizinyl, methylphosphinolizinyl, dibutylphthalazinyl, trimethylpteridinyl, methylphthaloperinyl, dimethylpurinyl, dibutylpyranyl, dibutylthiopyranal, trimethylpyrazinyl, phenylpyrazolyl, dipropylpyridazinyl, dimethylpyridinyl, methylpropylpyrindinyl, triethylpyrimidinyl, dibutylpyrrolyl, diethylpyrrolizinyl, dibutylquinazolinyl, dibutylquindolinyl, dibutyl-1*H*-quinindolinyl, dimethylquinolinyl, propylquinolizinyl, methylquinoxalinyl, methylbutylselenophenyl, methylthebenidinyl, dimethylthiazolyl,

trimethylthiophenyl, dibutyltriphenodioxazinyl, dibutyltriphenodithiazinyl, dibutylxanthenyl, trimethylchromanyl, dimethylthiochromanyl, dimethylimidazolidinyl, dimethylindolinyl, dibutylisochromanyl, dibutylisothiochromanyl, phenylisoindolinyl, dibutylmorpholinyl, dimethylpiperazinyl, dimethylpiperidinyl, dimethylpyrozolidinyl, dimethylpyrrolidinyl, bipyridyl, pyrido[2,1,6-*de*]quinolizinyl, hexamethylquinuclidinyl, 5,7-dioxa-6-phosphadibenzo[*a,c*]cycloheptene-6-oxide, 9-oxa-10-phosphaphenanthrene-10-oxide and the like; from all isomers of polar groups including methoxy, ethoxy, propoxy, butoxy, pentoxy, phenoxy, dimethylphenoxy, dimethylamino, diethylamino, dipropylamino, methylethylamino, methylpropylamino, ethylpropylamino, diphenylamino, methylphenylamino, ethylphenylamino, and the like.

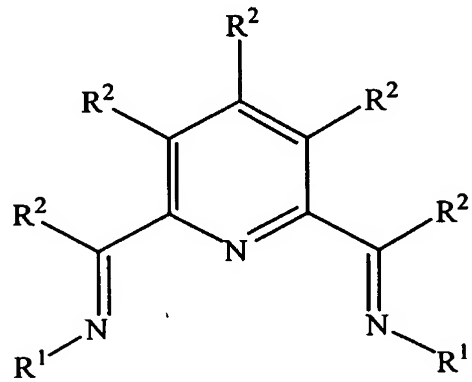
In some embodiments of the invention, it is preferred that at least one R^{11} and/or at least one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl; more preferably at least one R^{11} and one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl.

In one preferred embodiment, both R^2 join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure, with acenaphthylene, [1,4]-dithiane, piperazine, 1,4-dimethylpiperazine, bicyclo[2.2.1]heptane, 1,4-dimethyl[1,4]diazepane, methylcyclopentane, methyltetrahydrofuran, and methyldihydrofuran being the preferred ring structures, and with acenaphthylene being the most preferred ring structure. In another preferred embodiment, each R^2 is, independently, hydrogen, methyl, ethyl, propyl, or phenyl.

For the production of oligomer, the pre-catalyst structure preferably has both R^{11} or both R^{12} as hydrogen. Preferably both R^{11} and both R^{12} are hydrogen.

For the production of polymer, the pre-catalyst structure preferably has both R^{11} and both R^{12} other than hydrogen, however, one R^{11} or one R^{12} may be hydrogen.

In some embodiments of the invention, the catalyst precursor is represented by the formula L*2-MX, where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Fe or Co; X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality; and L*2 is a ligand represented by the general formula, L*2 ,

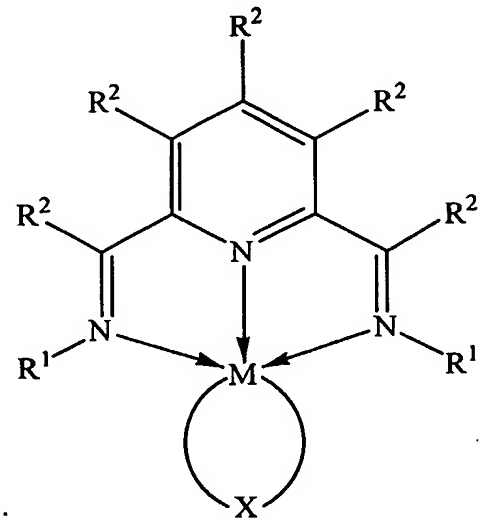


where N is nitrogen, R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; and R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$), and optionally two or more adjacent R^2 or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

Preferred L*2 ligands are those with R^2, independently, being hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl. Most preferred are R^2, independently, being hydrogen, methyl, ethyl, propyl, or phenyl.

Preferred R^1 substituents are, independently, of formulae S1 through S31, with S1, S7 and S16 being most preferred.

In another preferred embodiment catalysts precursors are represented by the formula:



TMC Formula 3:

where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Fe or Co;

N is nitrogen;

R^1 is, independently, a bulky hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent, and is preferably described by formulae S1 through S31, and most preferably described by formulae S1, S7 and S16;

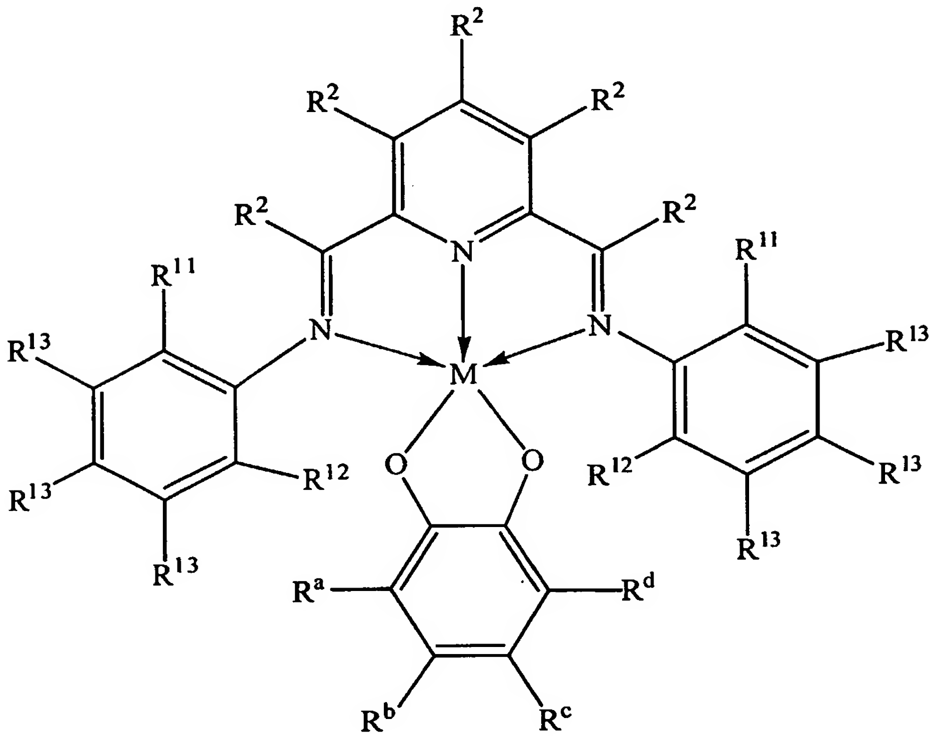
R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, and optionally two or more adjacent R^2 or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality.

Preferred R^2 are, independently, hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl.

More preferably, the precatalyst of TMC Formula 3 takes is represented by the following structure:

TMC Formula 4:



where M is a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Fe or Co;

N is nitrogen;

O is oxygen;

R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy, and optionally two or more adjacent R^2 or those separated by one additional atom may join together to form a substituted or

unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure;

R^{11}, R^{12}, and R^{13} are, independently, hydrogen, hydrocarbyl radicals, substituted hydrocarbyl radicals, halocarbyl radicals, substituted halocarbyl radicals, silylcarbyl radicals or polar radicals, and optionally, R^{11}, R^{12}, and/or two or more R^{13} on adjacent atoms may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

R^a, R^b, R^c and R^d are, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl, and optionally two or more adjacent R^a, R^b, R^c and/or R^d may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

Some invention embodiments, independently, select R^a, R^b, R^c and R^d from hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy,

phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group.

Some invention embodiments prefer that at least one R^a, R^b, R^c or R^d is not hydrogen.

Some invention embodiments select two or more adjacent R^a, R^b, R^c and/or R^d to join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent. Preferred structures of this type are represented by formulae X1 through X52.

Some invention embodiments, independently, select R^{10}, R^{11}, R^{12}, and R^{13} from hydrogen or hydrocarbyl radicals including methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl; from halocarbyls and all isomers of halocarbyls including perfluoropropyl, perfluorobutyl, perfluoropentyl, perfluorohexyl, perfluoroheptyl, perfluorooctyl, perfluorononyl, perfluorodecyl, perfluoroundecyl, perfluorododecyl, perfluorotridecyl, perfluorotetradecyl, perfluoropentadecyl, perfluorohexadecyl, perfluoroheptadecyl, perfluorooctadecyl, perfluorononadecyl, perfluoroeicosyl, perfluoroheneicosyl, perfluorodocosyl, perfluorotricosyl, perfluorotetracosyl, perfluoropentacosyl, perfluorohexacosyl, perfluoroheptacosyl, perfluorooctacosyl, perfluorononacosyl, perfluorotriacontyl, perfluorobutenyl, perfluorobutynyl, fluoropropyl, fluorobutyl, fluoropentyl, fluorohexyl, fluoroheptyl, fluorooctyl, fluorononyl, fluorodecyl,

fluoroundecyl, fluorododecyl, fluorotridecyl, fluorotetradecyl, fluoropentadecyl, fluorohexadecyl, fluoroheptadecyl, fluorooctadecyl, fluorononadecyl, fluoroeicosyl, fluoroheneicosyl, fluorodocosyl, fluorotricosyl, fluorotetracosyl, fluoropentacosyl, fluorohexacosyl, fluoroheptacosyl, fluorooctacosyl, fluorononacosyl, fluorotriacontyl, difluorobutyl, trifluorobutyl, tetrafluorobutyl, pentafluorobutyl, hexafluorobutyl, heptafluorobutyl, octafluorobutyl; from substituted hydrocarbyl radicals and all isomers of substituted hydrocarbyl radicals including methoxypropyl, methoxybutyl, methoxypentyl, methoxyhexyl, methoxyheptyl, methoxyoctyl, methoxynonyl, methoxydecyl, methoxyundecyl, methoxydodecyl, methoxytridecyl, methoxytetradecyl, methoxypentadecyl, methoxyhexadecyl, methoxyheptadecyl, methoxyoctadecyl, methoxynonadecyl, methoxyeicosyl, methoxyheneicosyl, methoxydocosyl, methoxytricosyl, methoxytetracosyl, methoxypentacosyl, methoxyhexacosyl, methoxyheptacosyl, methoxyoctacosyl, methoxynonacosyl, methoxytriacontyl, butoxypropyl, butoxybutyl, butoxypentyl, butoxyhexyl, butoxyheptyl, butoxyoctyl, butoxynonyl, butoxydecyl, butoxyundecyl, butoxydodecyl, butoxytridecyl, butoxytetradecyl, butoxypentadecyl, butoxyhexadecyl, butoxyheptadecyl, butoxyoctadecyl, butoxynonadecyl, butoxyeicosyl, butoxyheneicosyl, butoxydocosyl, butoxytricosyl, butoxytetracosyl, butoxypentacosyl, butoxyhexacosyl, butoxyheptacosyl, butoxyoctacosyl, butoxynonacosyl, butoxytriacontyl, dimethylaminopropyl, dimethylaminobutyl, dimethylaminopentyl, dimethylaminohexyl, dimethylaminoheptyl, dimethylaminooctyl, dimethylaminononyl, dimethylaminodecyl, dimethylaminoundecyl, dimethylaminododecyl, dimethylaminotridecyl, dimethylaminotetradecyl, dimethylaminopentadecyl, dimethylaminohexadecyl, dimethylaminoheptadecyl, dimethylaminooctadecyl, dimethylaminononadecyl, dimethylaminoeicosyl, dimethylaminoheneicosyl, dimethylaminodocosyl, dimethylaminotricosyl, dimethylaminotetracosyl, dimethylaminopentacosyl, dimethylaminohexacosyl, dimethylaminoheptacosyl, dimethylaminooctacosyl, dimethylaminononacosyl, dimethylaminotriacontyl, trimethylsilylpropyl, trimethylsilylbutyl, trimethylsilylpentyl, trimethylsilylhexyl, trimethylsilylheptyl, trimethylsilyloctyl, trimethylsilylnonyl, trimethylsilyldecyl, trimethylsilylundecyl, trimethylsilyldodecyl, trimethylsilyltridecyl, trimethylsilyltetradecyl, trimethylsilylpentadecyl, trimethylsilylhexadecyl, trimethylsilylheptadecyl,

trimethylsilyloctadecyl, trimethylsilylnonadecyl, trimethylsilyleicosyl, trimethylsilylheneicosyl, trimethylsilyldocosyl, trimethylsilyltricosyl, trimethylsilyltetracosyl, trimethylsilylpentacosyl, trimethylsilylhexacosyl, trimethylsilylheptacosyl, trimethylsilyloctacosyl, trimethylsilylnonacosyl, trimethylsilyltriacontyl and the like; from phenyl, and all isomers of hydrocarbyl substituted phenyl including methylphenyl, dimethylphenyl, trimethylphenyl, tetramethylphenyl, pentamethylphenyl ethylphenyl, diethylphenyl, triethylphenyl, tetraethylphenyl, pentaethylphenyl, propylphenyl, dipropylphenyl, tripropylphenyl, tetrapropylphenyl, pentapropylphenyl butylphenyl, dibutylphenyl, tributylphenyl, tetrabutylphenyl, pentabutylphenyl, hexylphenyl, dihexylphenyl, trihexylphenyl, tetrahexylphenyl, pentahexylphenyl, dimethylethylphenyl, dimethylpropylphenyl, dimethylbutylphenyl, dimethylpentylphenyl, dimethylhexylphenyl, diethylmethylphenyl, diethylpropylphenyl, diethylbutylphenyl, diethylpentylphenyl, diethylhexylphenyl, dipropylmethylphenyl, dipropylethylphenyl, dipropylbutylphenyl, dipropylpentylphenyl, dipropylhexylphenyl, dibutylmethylphenyl, dibutylethylphenyl, dibutylpropylphenyl, dibutylpentylphenyl, dibutylhexylphenyl, methylethylphenyl, methylpropylphenyl, methylbutylphenyl, methylpentylphenyl, methylhexylphenyl, ethylpropylphenyl, ethylbutylphenyl, ethylpentylphenyl, ethylhexylphenyl, propylbutylphenyl, propylpentylphenyl, propylhexylphenyl, butylpentylphenyl, butylhexylphenyl, trimethylsilylphenyl, trimethylgermylphenyl, trifluoromethylphenyl, bis(triflouromethyl)phenyl and the like; from all isomers of halo substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halophenyl, dihalophenyl, trihalophenyl, tetrahalophenyl, and pentahalophenyl; from all isomers of halo substituted hydrocarbyl substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halomethylphenyl, dihalomethylphenyl, trihalomethylphenyl, tetrahalomethylphenyl, haloethlyphenyl, dihaloethylphenyl, trihaloethylphenyl, tetrahaloethylphenyl, halopropylphenyl, dihalopropylphenyl, trihalopropylphenyl, tetrahalopropylphenyl, halobutylphenyl, dihalobutylphenyl, trihalobutylphenyl, tetrahalobutylphenyl, dihalodimethylphenyl, dihalo(trifluoromethyl)phenyl and the like; from all isomers of benzyl, and all isomers of hydrocarbyl substituted benzyl including methylbenzyl, dimethylbenzyl, trimethylbenzyl, tetramethylbenzyl, pentamethylbenzyl ethylbenzyl, diethylbenzyl, triethylbenzyl, tetraethylbenzyl,

pentaethylbenzyl, propylbenzyl, dipropylbenzyl, tripropylbenzyl, tetrapropylbenzyl, pentapropylbenzyl butylbenzyl, dibutylbenzyl, tributylbenzyl, tetrabutylbenzyl, pentabutylbenzyl, hexylbenzyl, dihexylbenzyl, trihexylbenzyl, tetrahexylbenzyl, pentahexylbenzyl, dimethylethylbenzyl, dimethylpropylbenzyl, dimethylbutylbenzyl, dimethylpentylbenzyl, dimethylhexylbenzyl, diethylmethylbenzyl, diethylpropylbenzyl, diethylbutylbenzyl, diethylpentylbenzyl, diethylhexylbenzyl, dipropylmethylbenzyl, dipropylethylbenzyl, dipropylbutylbenzyl, dipropylpentylbenzyl, dipropylhexylbenzyl, dibutylmethylbenzyl, dibutylethylbenzyl, dibutylpropylbenzyl, dibutylpentylbenzyl, dibutylhexylbenzyl, methylethylbenzyl, methylpropylbenzyl, methylbutylbenzyl, methylpentylbenzyl, methylhexylbenzyl, ethylpropylbenzyl, ethylbutylbenzyl, ethylpentylbenzyl, ethylhexylbenzyl, propylbutylbenzyl, propylpentylbenzyl, propylhexylbenzyl, butylpentylbenzyl, butylhexylbenzyl, trimethylsilylbenzyl, bis(trimethylsilyl)benzyl, trimethylgermylbenzyl, diphenylmethyl and the like; from trihydrocarbyl-silyl, –germyls, -stannyls and -plumbyls including trimethylsilyl, trimethylgermyl, trimethylstannyl, trimethylplumbyl, triethylsilyl, triethylgermyl, dimethylethylsilyl, dimethylethylgermyl, diethylmethylsilyl, diethylmethylgermyl, triphenylsilyl, triphenylgermyl, and all isomers of tripropylsilyl, tripropylgermyl, tributylsilyl, tributylgermyl, tris(trifluormethyl)silyl, bis(perfluoromethyl)methylsilyl, and the like; from all isomers and hydrocarbyl substituted isomers of polycyclic areneyls including pyrenyl, aceanthrylenyl, acenaphthylene, acephenanthrylenyl, azulenyl biphenylenyl, chrysenyl, coronenyl, fluoranthenyl, fluorenyl, heptacenyl, heptalenyl, heptaphenyl, hexacenyl, hexaphenyl, *as*-indacenyl, *s*-indecenyl, indenyl, ovalenyl, pentacenyl, pentalenyl, pentaphenyl, perylenyl, phenalenyl, phenanthrenyl, picenyl, pleiadenyl, pyranhrenyl, rubicenyl, naphthacenyl, tetraphenylenyl, trinaphthylenyl, triphenylenyl, hexahelicenyl, naphthyl, anthracenyl, dibenza[*a,b*]anthracenyl, indanyl, acenaphthenyl, cholanthrenyl, aceanthrenyl, acephenanthrenyl, 1,2,3,4-tetrahydronapthalene, fullerenyl, and the like; from all isomers and hydrocarbyl substituted isomers of alicyclic monocyclic and polycyclic hydrocarbon rings including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, and cyclododecyl, dimethylcyclohexyl, norbornyl, norbornenyl, adamantyl, cubanyl, prismanyl, spiro[4,5]decanyl, and the like; from all isomers and hydrocarbyl substituted isomers

of ring assemblies including biphenyl, bicyclopentyl, terphenyl, quatercyclohexanyl, binaphthyl, binorbornyl, phenyl-terphenyl, and the like; from all isomers and hydrocarbyl substituted isomers of bridged monocyclic and polycyclic arenyls including 1,1-diphenylmethano, 1,1-dinapthyletheno, and the like; from all isomers of heterocycles and hydrocarbyl substituted heterocycles including acridarsinyl, acridinyl, acridophosphinyl, 1*H*-acrindolinyl, anthrazinyl, anthyridinyl, arsanthridinyl, arsindolyl, arsindolizinyl, arsinolinyl, arsinolizinyl, benzofuranyl, carbazolyl, β-carbolinyl, chromenyl, thiochromenyl, cinnolinyl, furanyl, imidazolyl, indazolyl, indolyl, indolizinyl, isoarsindolyl, isoarsinolinyl, isobenzofuranyl, isochromenyl, isothiochromenyl, isoindolyl, isophosphindolyl, isophosphinolinyl, isoquinolinyl, isothiazolyl, isoxazolyl, naphthyridinyl, oxazolyl, perimidinyl, phenanthrazinyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phosphanthridinyl, phosphindolyl, phosphindolizinyl, phosphinolizinyl, phthalazinyl, pteridinyl, phthaloperinyl, purinyl, pyranyl, thiopyranal, pyrazinyl, pyrazolyl, pyridazinyl, pyridinyl, pyrindinyl, pyrimidinyl, pyrrolyl, pyrrolizinyl, quinazolinyl, quindolinyl, 1*H*-quinindolinyl, quinolinyl, quinolizinyl, quinoxalinyl, selenophenyl, thebenidinyl, thiazolyl, thiophenyl, triphenodioxazinyl, triphenodithiazinyl, xanthenyl, chromanyl, thiochromanyl, imidazolidinyl, indolinyl, isochromanyl, isothiochromanyl, isoindolinyl, morpholinyl, piperazinyl, piperidinyl, pyrozolidinyl, pyrrolidinyl, quinuclidinyl, dimethylacridarsinyl, dimethylacridinyl, dimethylacridophosphinyl, dimethyl-1*H*-acrindolinyl, dimethylanthrazinyl, dimethylanthyridinyl, dimethylarsanthridinyl, dimethylarsindolyl, dimethylarsindolizinyl, dimethylarsinolinyl, dimethylarsinolizinyl, dibutylbenzofuranyl, dibutylcarbazolyl, dibutyl-β-carbolinyl, dibutylchromenyl, dibutylthiochromenyl, butylcinnolinyl, dibutylfuranyl, dimethylimidazolyl, dimethylindazolyl, dipropylindolyl, dipropylindolizinyl, dimethylisoarsindolyl, methylisoarsinolinyl, dimethylisobenzofuranyl, diphenylisochromenyl, dibutylisothiochromenyl, phenylisoindolyl, butylisophosphindolyl, dibutylisophosphinolinyl, dimethylisoquinolinyl, methylisothiazolyl, butylisoxazolyl, butylnaphthyridinyl, dimethyloxazolyl, methylphenylperimidinyl, tetrabutylphenanthrazinyl, propylphenanthridinyl, dibutylphenanthrolinyl, tetramethylphenazinyl, butylphosphanthridinyl, phenylphosphindolyl, dimethylphosphindolizinyl, methylphosphinolizinyl, dibutylphthalazinyl, trimethylpteridinyl,

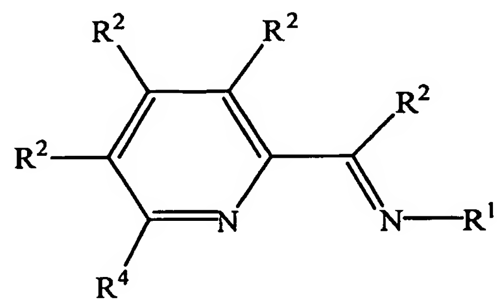
methylphthaloperinyl, dimethylpurinyl, dibutylpyranyl, dibutylthiopyranal, trimethylpyrazinyl, phenylpyrazolyl, dipropylpyridazinyl, dimethylpyridinyl, methylpropylpyrindinyl, triethylpyrimidinyl, dibutylpyrrolyl, diethylpyrrolizinyl, dibutylquinazolinyl, dibutylquindolinyl, dibutyl-1*H*-quinindolinyl, dimethylquinolinyl, propylquinolizinyl, methylquinoxalinyl, methylbutylselenophenyl, methylthebenidinyl, dimethylthiazolyl, trimethylthiophenyl, dibutyltriphenodioxazinyl, dibutyltriphenodithiazinyl, dibutylxanthenyl, trimethylchromanyl, dimethylthiochromanyl, dimethylimidazolidinyl, dimethylindolinyl, dibutylisochromanyl, dibutylisothiochromanyl, phenylisoindolinyl, dibutylmorpholinyl, dimethylpiperazinyl, dimethylpiperidinyl, dimethylpyrozolidinyl, dimethylpyrrolidinyl, bipyridyl, pyrido[2,1,6-*de*]quinolizinyl, hexamethylquinuclidinyl, 5,7-dioxa-6-phosphadibenzo[*a,c*]cycloheptene-6-oxide, 9-oxa-10-phosphaphenanthrene-10-oxide and the like; from all isomers of polar groups including methoxy, ethoxy, propoxy, butoxy, pentoxy, phenoxy, dimethylphenoxy, dimethylamino, diethylamino, dipropylamino, methylethylamino, methylpropylamino, ethylpropylamino, diphenylamino, methylphenylamino, ethylphenylamino, and the like.

In some embodiments of the invention, it is preferred that at least one R^{11} and/or at least one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl; more preferably at least one R^{11} and one R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl.

For the production of oligomer, the pre-catalyst structure preferably has both R^{11} or both R^{12} as hydrogen. Alternatively both R^{11} and both R^{12} are hydrogen. Alternatively, R^{11} and R^{12} on the same aryl ring are hydrogen and on the other aryl ring are not hydrogen.

For the production of polymer, the pre-catalyst structure preferably has both R^{11} and both R^{12} other than hydrogen, however, one R^{11} or one R^{12} may be hydrogen.

In some embodiments of the invention, the catalyst precursor is represented by the formula L*13-MX, where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Ni or Pd; X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality; and L*3 is ligand represented by the general formula, L*13 ,



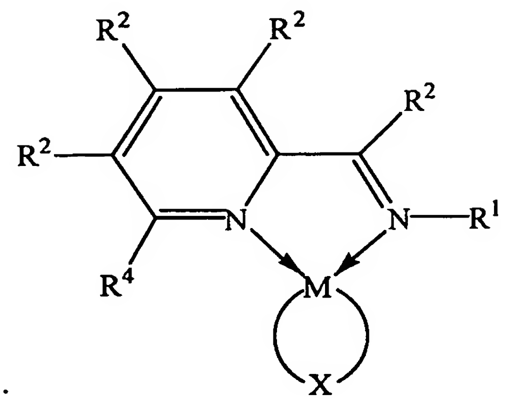
where N is nitrogen, R^1 is, independently, a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl; R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy (e.g. $-OSiMe_3$), and R^4 is hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl, but is preferably a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl as defined for R^1, and where and optionally two or more adjacent R^2 and/or R^4, or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure.

Preferred L*13 ligands are those with R^2, independently, being hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl. Most preferred are R^2, independently, being hydrogen, methyl, ethyl, propyl, or phenyl.

Preferred R^1 substituents are, independently, of formulae S1 through S31, with S1, S7 and S16 being most preferred.

Still in other embodiments, the catalyst precursor is represented by the formula:

TMC Formula 5:



where M is a Group 3-11 transition metal, preferably a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Ni or Pd;

N is nitrogen;

R^1 is, independently, a bulky hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent, and is preferably described by formulae S1 through S31, and most preferably described by formulae S1, S7 and S16;

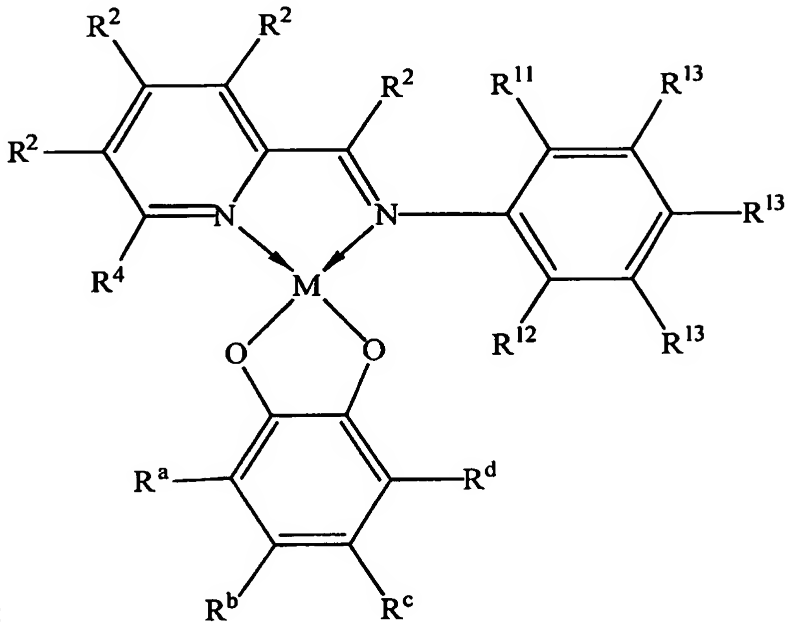
R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy; R^4 is hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl, but is preferably a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl as defined for R^1; and where optionally two or more adjacent R^2 and/or R^4, or those separated by one additional atom may join together to form a substituted or unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

X is a substituted or unsubstituted catecholate ligand provided that the substituted catecholate ligand does not contain a 1,2-diketone functionality.

Preferred R^2 are, independently, hydrogen, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, undecyl, dodecyl, phenyl, and pyridyl.

Preferred precatalysts also include those represented by the following structure:

TMC Formula 6:



where M is a Group 8, 9, 10, or 11 transition metal, more preferably, Fe, Co, Ni, or Pd, and even more preferably Ni or Pd;

N is nitrogen;

O is oxygen;

R^2 is, independently, hydrogen, or a hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl substituent provided that a substituted hydrocarbyl is not substituted with trihydrocarbylsiloxy; R^4 is hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl, or substituted halocarbyl, but is preferably a bulky hydrocarbyl, substituted bulky hydrocarbyl, bulky halocarbyl, or substituted bulky halocarbyl as defined for R^1; and where optionally two or more adjacent R^2 and/or R^4, or those separated by one additional atom may join together to form a substituted or

unsubstituted, saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure;

R^{11}, R^{12}, and R^{13} are, independently, hydrogen, hydrocarbyl radicals, substituted hydrocarbyl radicals, halocarbyl radicals, substituted halocarbyl radicals, silylcarbyl radicals or polar radicals, and optionally, R^{11}, R^{12}, and/or two or more R^{13} on adjacent atoms may join together to form a substituted or unsubstituted saturated, partially unsaturated or aromatic cyclic or polycyclic ring structure; and

R^a, R^b, R^c and R^d are, independently, hydrogen, hydrocarbyl, substituted hydrocarbyl, halocarbyl or substituted halocarbyl, and optionally two or more adjacent R^a, R^b, R^c and/or R^d may join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent.

Some invention embodiments, independently, select R^a, R^b, R^c and R^d from hydrogen, methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl, phenyl, napthyl, anthracenyl, pyrenyl, biphenyl, benzyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, cyclododecyl, fluoro, chloro, bromo, iodo, trimethylsilyl, triethylsilyl, tripropylsilyl, dimethylethylsilyl, diethylmethylsilyl, trimethoxysilyl, tirethoxysilyl, tripropoxysilyl, methoxy, ethoxy, propoxy, butoxy,

phenoxy, or a nitro, carboxylic acid, ester, ketone (excluding 1,2-diketones) or aldehyde group.

Some invention embodiments prefer that at least one R^a, R^b, R^c or R^d is not hydrogen.

Some invention embodiments select two or more adjacent R^a, R^b, R^c and/or R^d to join together to form a substituted or unsubstituted, saturated, partially unsaturated, or aromatic cyclic or polycyclic substituent. Preferred structures of this type are represented by formulae X1 through X52.

Some invention embodiments select R^{10}, R^{11}, R^{12}, and R^{13} from hydrogen or hydrocarbyl radicals including methyl, ethyl, ethenyl, ethynyl and all isomers of propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, tridecenyl, tetradecenyl, pentadecenyl, hexadecenyl, heptadecenyl, octadecenyl, nonadecenyl, eicosenyl, heneicosenyl, docosenyl, tricosenyl, tetracosenyl, pentacosenyl, hexacosenyl, heptacosenyl, octacosenyl, nonacosenyl, triacontenyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, tridecynyl, tetradecynyl, pentadecynyl, hexadecynyl, heptadecynyl, octadecynyl, nonadecynyl, eicosynyl, heneicosynyl, docosynyl, tricosynyl, tetracosynyl, pentacosynyl, hexacosynyl, heptacosynyl, octacosynyl, nonacosynyl, and triacontynyl; from halocarbyls and all isomers of halocarbyls including perfluoropropyl, perfluorobutyl, perfluoropentyl, perfluorohexyl, perfluoroheptyl, perfluorooctyl, perfluorononyl, perfluorodecyl, perfluoroundecyl, perfluorododecyl, perfluorotridecyl, perfluorotetradecyl, perfluoropentadecyl, perfluorohexadecyl, perfluoroheptadecyl, perfluorooctadecyl, perfluorononadecyl, perfluoroeicosyl, perfluoroheneicosyl, perfluorodocosyl, perfluorotricosyl, perfluorotetracosyl, perfluoropentacosyl, perfluorohexacosyl, perfluoroheptacosyl, perfluorooctacosyl, perfluorononacosyl, perfluorotriacontyl, perfluorobutenyl, perfluorobutynyl, fluoropropyl, fluorobutyl, fluoropentyl, fluorohexyl, fluoroheptyl, fluorooctyl, fluorononyl, fluorodecyl, fluoroundecyl,

fluorododecyl, fluorotridecyl, fluorotetradecyl, fluoropentadecyl, fluorohexadecyl, fluoroheptadecyl, fluorooctadecyl, fluorononadecyl, fluoroeicosyl, fluoroheneicosyl, fluorodocosyl, fluorotricosyl, fluorotetracosyl, fluoropentacosyl, fluorohexacosyl, fluoroheptacosyl, fluorooctacosyl, fluorononacosyl, fluorotriacontyl, difluorobutyl, trifluorobutyl, tetrafluorobutyl, pentafluorobutyl, hexafluorobutyl, heptafluorobutyl, octafluorobutyl; from substituted hydrocarbyl radicals and all isomers of substituted hydrocarbyl radicals including methoxypropyl, methoxybutyl, methoxypentyl, methoxyhexyl, methoxyheptyl, methoxyoctyl, methoxynonyl, methoxydecyl, methoxyundecyl, methoxydodecyl, methoxytridecyl, methoxytetradecyl, methoxypentadecyl, methoxyhexadecyl, methoxyheptadecyl, methoxyoctadecyl, methoxynonadecyl, methoxyeicosyl, methoxyheneicosyl, methoxydocosyl, methoxytricosyl, methoxytetracosyl, methoxypentacosyl, methoxyhexacosyl, methoxyheptacosyl, methoxyoctacosyl, methoxynonacosyl, methoxytriacontyl, butoxypropyl, butoxybutyl, butoxypentyl, butoxyhexyl, butoxyheptyl, butoxyoctyl, butoxynonyl, butoxydecyl, butoxyundecyl, butoxydodecyl, butoxytridecyl, butoxytetradecyl, butoxypentadecyl, butoxyhexadecyl, butoxyheptadecyl, butoxyoctadecyl, butoxynonadecyl, butoxyeicosyl, butoxyheneicosyl, butoxydocosyl, butoxytricosyl, butoxytetracosyl, butoxypentacosyl, butoxyhexacosyl, butoxyheptacosyl, butoxyoctacosyl, butoxynonacosyl, butoxytriacontyl, dimethylaminopropyl, dimethylaminobutyl, dimethylaminopentyl, dimethylaminohexyl, dimethylaminoheptyl, dimethylaminooctyl, dimethylaminononyl, dimethylaminodecyl, dimethylaminoundecyl, dimethylaminododecyl, dimethylaminotridecyl, dimethylaminotetradecyl, dimethylaminopentadecyl, dimethylaminohexadecyl, dimethylaminoheptadecyl, dimethylaminooctadecyl, dimethylaminononadecyl, dimethylaminoeicosyl, dimethylaminoheneicosyl, dimethylaminodocosyl, dimethylaminotricosyl, dimethylaminotetracosyl, dimethylaminopentacosyl, dimethylaminohexacosyl, dimethylaminoheptacosyl, dimethylaminooctacosyl, dimethylaminononacosyl, dimethylaminotriacontyl, trimethylsilylpropyl, trimethylsilylbutyl, trimethylsilylpentyl, trimethylsilylhexyl, trimethylsilylheptyl, trimethylsilyloctyl, trimethylsilylnonyl, trimethylsilyldecyl, trimethylsilylundecyl, trimethylsilyldodecyl, trimethylsilyltridecyl, trimethylsilyltetradecyl, trimethylsilylpentadecyl, trimethylsilylhexadecyl, trimethylsilylheptadecyl, trimethylsilyloctadecyl,

trimethylsilylnonadecyl, trimethylsilyleicosyl, trimethylsilylheneicosyl, trimethylsilyldocosyl, trimethylsilyltricosyl, trimethylsilyltetracosyl, trimethylsilylpentacosyl, trimethylsilylhexacosyl, trimethylsilylheptacosyl, trimethylsilyloctacosyl, trimethylsilylnonacosyl, trimethylsilyltriacontyl and the like; from phenyl, and all isomers of hydrocarbyl substituted phenyl including methylphenyl, dimethylphenyl, trimethylphenyl, tetramethylphenyl, pentamethylphenyl ethylphenyl, diethylphenyl, triethylphenyl, tetraethylphenyl, pentaethylphenyl, propylphenyl, dipropylphenyl, tripropylphenyl, tetrapropylphenyl, pentapropylphenyl butylphenyl, dibutylphenyl, tributylphenyl, tetrabutylphenyl, pentabutylphenyl, hexylphenyl, dihexylphenyl, trihexylphenyl, tetrahexylphenyl, pentahexylphenyl, dimethylethylphenyl, dimethylpropylphenyl, dimethylbutylphenyl, dimethylpentylphenyl, dimethylhexylphenyl, diethylmethylphenyl, diethylpropylphenyl, diethylbutylphenyl, diethylpentylphenyl, diethylhexylphenyl, dipropylmethylphenyl, dipropylethylphenyl, dipropylbutylphenyl, dipropylpentylphenyl, dipropylhexylphenyl, dibutylmethylphenyl, dibutylethylphenyl, dibutylpropylphenyl, dibutylpentylphenyl, dibutylhexylphenyl, methylethylphenyl, methylpropylphenyl, methylbutylphenyl, methylpentylphenyl, methylhexylphenyl, ethylpropylphenyl, ethylbutylphenyl, ethylpentylphenyl, ethylhexylphenyl, propylbutylphenyl, propylpentylphenyl, propylhexylphenyl, butylpentylphenyl, butylhexylphenyl, trimethylsilylphenyl, trimethylgermylphenyl, trifluoromethylphenyl, bis(triflouromethyl)phenyl and the like; from all isomers of halo substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halophenyl, dihalophenyl, trihalophenyl, tetrahalophenyl, and pentahalophenyl; from all isomers of halo substituted hydrocarbyl substituted phenyl (where halo is, independently, fluoro, chloro, bromo and iodo) including halomethylphenyl, dihalomethylphenyl, trihalomethylphenyl, tetrahalomethylphenyl, haloethlyphenyl, dihaloethylphenyl, trihaloethylphenyl, tetrahaloethylphenyl, halopropylphenyl, dihalopropylphenyl, trihalopropylphenyl, tetrahalopropylphenyl, halobutylphenyl, dihalobutylphenyl, trihalobutylphenyl, tetrahalobutylphenyl, dihalodimethylphenyl, dihalo(trifluoromethyl)phenyl and the like; from all isomers of benzyl, and all isomers of hydrocarbyl substituted benzyl including methylbenzyl, dimethylbenzyl, trimethylbenzyl, tetramethylbenzyl, pentamethylbenzyl ethylbenzyl, diethylbenzyl, triethylbenzyl, tetraethylbenzyl, pentaethylbenzyl, propylbenzyl,

dipropylbenzyl, tripropylbenzyl, tetrapropylbenzyl, pentapropylbenzyl butylbenzyl, dibutylbenzyl, tributylbenzyl, tetrabutylbenzyl, pentabutylbenzyl, hexylbenzyl, dihexylbenzyl, trihexylbenzyl, tetrahexylbenzyl, pentahexylbenzyl, dimethylethylbenzyl, dimethylpropylbenzyl, dimethylbutylbenzyl, dimethylpentylbenzyl, dimethylhexylbenzyl, diethylmethylbenzyl, diethylpropylbenzyl, diethylbutylbenzyl, diethylpentylbenzyl, diethylhexylbenzyl, dipropylmethylbenzyl, dipropylethylbenzyl, dipropylbutylbenzyl, dipropylpentylbenzyl, dipropylhexylbenzyl, dibutylmethylbenzyl, dibutylethylbenzyl, dibutylpropylbenzyl, dibutylpentylbenzyl, dibutylhexylbenzyl, methylethylbenzyl, methylpropylbenzyl, methylbutylbenzyl, methylpentylbenzyl, methylhexylbenzyl, ethylpropylbenzyl, ethylbutylbenzyl, ethylpentylbenzyl, ethylhexylbenzyl, propylbutylbenzyl, propylpentylbenzyl, propylhexylbenzyl, butylpentylbenzyl, butylhexylbenzyl, trimethylsilylbenzyl, bis(trimethylsilyl)benzyl, trimethylgermylbenzyl, diphenylmethyl and the like; from trihydrocarbyl-silyl, – germyls, -stannyls and -plumbyls including trimethylsilyl, trimethylgermyl, trimethylstannyl, trimethylplumbyl, triethylsilyl, triethylgermyl, dimethylethylsilyl, dimethylethylgermyl, diethylmethylsilyl, diethylmethylgermyl, triphenylsilyl, triphenylgermyl, and all isomers of tripropylsilyl, tripropylgermyl, tributylsilyl, tributylgermyl, tris(trifluormethyl)silyl, bis(perfluoromethyl)methylsilyl, and the like; from all isomers and hydrocarbyl substituted isomers of polycyclic areneyls including pyrenyl, aceanthrylenyl, acenaphthylene, acephenanthrylenyl, azulenyl biphenylenyl, chrysenyl, coronenyl, fluoranthenyl, fluorenyl, heptacenyl, heptalenyl, heptaphenyl, hexacenyl, hexaphenyl, *as*-indacenyl, *s*-indecenyl, indenyl, ovalenyl, pentacenyl, pentalenyl, pentaphenyl, perylenyl, phenalenyl, phenanthrenyl, picenyl, pleiadenyl, pyranhrenyl, rubicenyl, naphthacenyl, tetraphenylenyl, trinaphthylenyl, triphenylenyl, hexahelicenyl, naphthyl, anthracenyl, dibenza[*a,b*]anthracenyl, indanyl, acenaphthenyl, cholanthrenyl, aceanthrenyl, acephenanthrenyl, 1,2,3,4-tetrahydronapthalene, fullerenyl, and the like; from all isomers and hydrocarbyl substituted isomers of alicyclic monocyclic and polycyclic hydrocarbon rings including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl, and cyclododecyl, dimethylcyclohexyl, norbornyl, norbornenyl, adamantyl, cubanyl, prismanyl, spiro[4,5]decanyl, and the like; from all isomers and hydrocarbyl substituted isomers

of ring assemblies including biphenyl, bicyclopentyl, terphenyl, quatercyclohexanyl, binaphthyl, binorbornyl, phenyl-terphenyl, and the like; from all isomers and hydrocarbyl substituted isomers of bridged monocyclic and polycyclic arenyls including 1,1-diphenylmethano, 1,1-dinapthyletheno, and the like; from all isomers of heterocycles and hydrocarbyl substituted heterocycles including acridarsinyl, acridinyl, acridophosphinyl, 1*H*-acrindolinyl, anthrazinyl, anthyridinyl, arsanthridinyl, arsindolyl, arsindolizinyl, arsinolinyl, arsinolizinyl, benzofuranyl, carbazolyl, β-carbolinyl, chromenyl, thiochromenyl, cinnolinyl, furanyl, imidazolyl, indazolyl, indolyl, indolizinyl, isoarsindolyl, isoarsinolinyl, isobenzofuranyl, isochromenyl, isothiochromenyl, isoindolyl, isophosphindolyl, isophosphinolinyl, isoquinolinyl, isothiazolyl, isoxazolyl, naphthyridinyl, oxazolyl, perimidinyl, phenanthrazinyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phosphanthridinyl, phosphindolyl, phosphindolizinyl, phosphinolizinyl, phthalazinyl, pteridinyl, phthaloperinyl, purinyl, pyranyl, thiopyranal, pyrazinyl, pyrazolyl, pyridazinyl, pyridinyl, pyrindinyl, pyrimidinyl, pyrrolyl, pyrrolizinyl, quinazolinyl, quindolinyl, 1*H*-quinindolinyl, quinolinyl, quinolizinyl, quinoxalinyl, selenophenyl, thebenidinyl, thiazolyl, thiophenyl, triphenodioxazinyl, triphenodithiazinyl, xanthenyl, chromanyl, thiochromanyl, imidazolidinyl, indolinyl, isochromanyl, isothiochromanyl, isoindolinyl, morpholinyl, piperazinyl, piperidinyl, pyrozolidinyl, pyrrolidinyl, quinuclidinyl, dimethylacridarsinyl, dimethylacridinyl, dimethylacridophosphinyl, dimethyl-1*H*-acrindolinyl, dimethylanthrazinyl, dimethylanthyridinyl, dimethylarsanthridinyl, dimethylarsindolyl, dimethylarsindolizinyl, dimethylarsinolinyl, dimethylarsinolizinyl, dibutylbenzofuranyl, dibutylcarbazolyl, dibutyl-β-carbolinyl, dibutylchromenyl, dibutylthiochromenyl, butylcinnolinyl, dibutylfuranyl, dimethylimidazolyl, dimethylindazolyl, dipropylindolyl, dipropylindolizinyl, dimethylisoarsindolyl, methylisoarsinolinyl, dimethylisobenzofuranyl, diphenylisochromenyl, dibutylisothiochromenyl, phenylisoindolyl, butylisophosphindolyl, dibutylisophosphinolinyl, dimethylisoquinolinyl, methylisothiazolyl, butylisoxazolyl, butylnaphthyridinyl, dimethyloxazolyl, methylphenylperimidinyl, tetrabutylphenanthrazinyl, propylphenanthridinyl, dibutylphenanthrolinyl, tetramethylphenazinyl, butylphosphanthridinyl, phenylphosphindolyl, dimethylphosphindolizinyl, methylphosphinolizinyl, dibutylphthalazinyl, trimethylpteridinyl,

methylphthaloperinyl, dimethylpurinyl, dibutylpyranyl, dibutylthiopyranal, trimethylpyrazinyl, phenylpyrazolyl, dipropylpyridazinyl, dimethylpyridinyl, methylpropylpyrindinyl, triethylpyrimidinyl, dibutylpyrrolyl, diethylpyrrolizinyl, dibutylquinazolinyl, dibutylquindolinyl, dibutyl-1*H*-quinindolinyl, dimethylquinolinyl, propylquinolizinyl, methylquinoxalinyl, methylbutylselenophenyl, methylthebenidinyl, dimethylthiazolyl, trimethylthiophenyl, dibutyltriphenodioxazinyl, dibutyltriphenodithiazinyl, dibutylxanthenyl, trimethylchromanyl, dimethylthiochromanyl, dimethylimidazolidinyl, dimethylindolinyl, dibutylisochromanyl, dibutylisothiochromanyl, phenylisoindolinyl, dibutylmorpholinyl, dimethylpiperazinyl, dimethylpiperidinyl, dimethylpyrozolidinyl, dimethylpyrrolidinyl, bipyridyl, pyrido[2,1,6-*de*]quinolizinyl, hexamethylquinuclidinyl, 5,7-dioxa-6-phosphadibenzo[*a,c*]cycloheptene-6-oxide, 9-oxa-10-phosphaphenanthrene-10-oxide and the like; from all isomers of polar groups including methoxy, ethoxy, propoxy, butoxy, pentoxy, phenoxy, dimethylphenoxy, dimethylamino, diethylamino, dipropylamino, methylethylamino, methylpropylamino, ethylpropylamino, diphenylamino, methylphenylamino, ethylphenylamino, and the like.

In some embodiments of the invention, it is preferred that R^{11} and/or R^{12} are, independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl; more preferably R^{11} and R^{12} ar,e independently, methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *iso*-butyl, *tert*-butyl, phenyl, napthyl, diphenylmethyl, or trifluoromethyl.

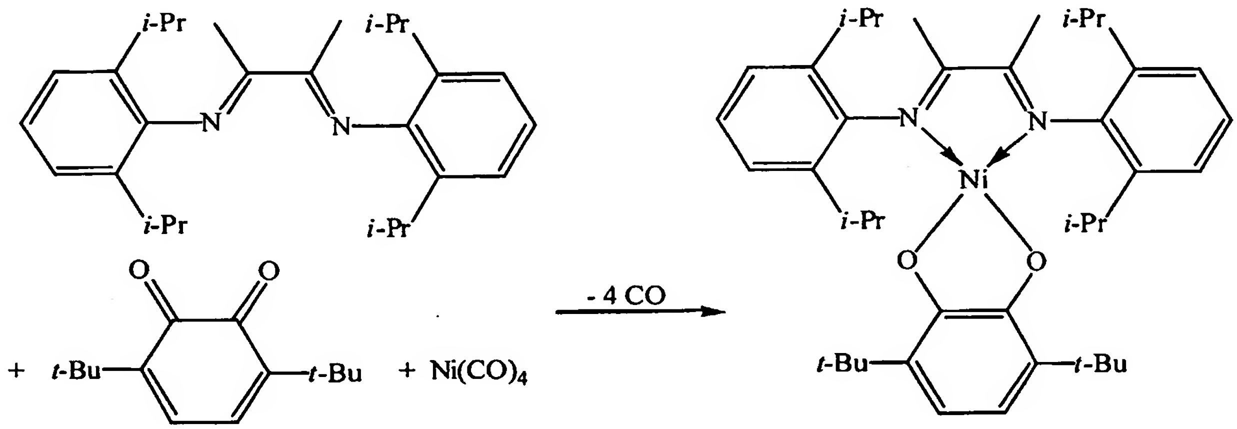
For the production of oligomer, the pre-catalyst structure preferably has R^{11} or R^{12} as hydrogen. Preferably both R^{11} and R^{12} are hydrogen. Additionally, R^4 is preferably hydrogen, methyl, ethyl, *n*-propyl, or *n*-butyl, or R^4 and the adjacent R^2 join to form a fused phenyl ring.

For the production of polymer, the pre-catalyst structure preferably has both R^{11} and R^{12} other than hydrogen, however, one R^{11} or one R^{12} may be hydrogen.

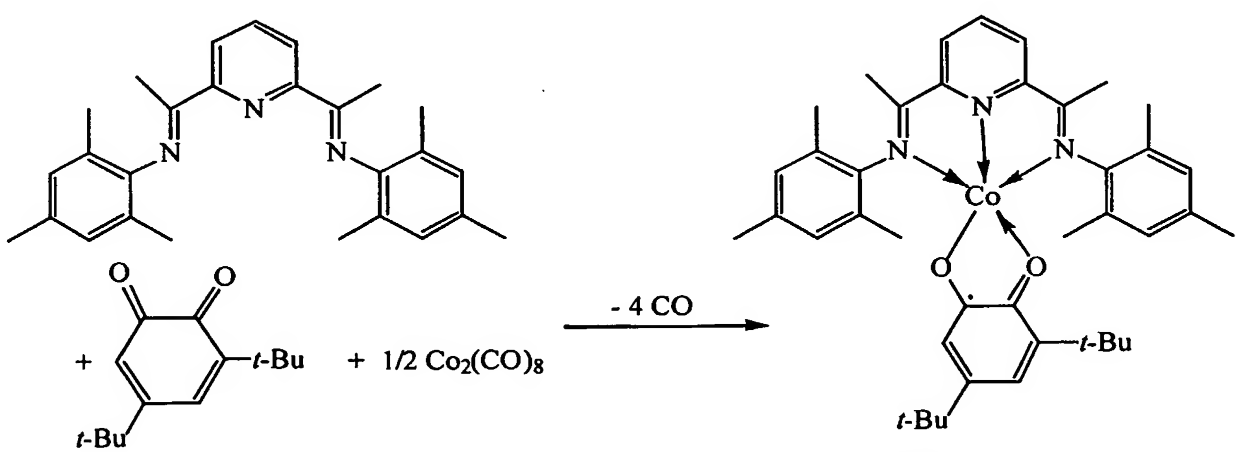
Additionally, R^4 is preferably a substituted or unsubstituted phenyl, naphthyl, adamantyl or cyclohexyl substituent.

The transition metal compounds of this invention may be prepared by multiple methods. A first method of preparation uses a zero formal oxidation state transition metal or transition metal complex, such as a metal carbonyl complex, a bidentate or tridentate chelating ligand, and a 1,2-benzoquinone complex to form the complex of the invention. Depending on the metal complex used, the oxidation of the metal may be a one or two electron oxidation. Examples of this redox reaction are illustrated below:

Formation of a nickel (II) complex:



Formation of a cobalt (I) complex:



Zero formal oxidation state transition metals or transition metal complexes that may be used include nickel carbonyl ($Ni(CO)_4$), bis(1,5-cyclooctadiene) nickel, bis(triphenylphosphine)nickel dicarbonyl, tetrakis(trifluorophosphine) nickel, nickel powder, tetrakis(thiocarbonyl)nickel, tricarbonyl(methyl isocyanide)nickel,

dicarbonyl[bis(trifluoromethyl)acetylene]nickel, bis(acrylonitrile)nickel, dicarbonylbis(methyl isocyanide)nickel, (trimethyl phosphite)nickel tricarbonyl, tris(ethylene)nickel, carbonyltris(methyl isocyanide)nickel, tricarbonyl(diethylsulfide)nickel, tetrakis(methyl isocyanide)nickel, dicarbonylbis(trimethylphosphine)nickel, carbonyltris(trimethylphosphine)nickel, (1,5-cyclooctadiene)(hexafluoropropylene)nickel, tetrakis(trimethylphosphite-*P*)nickel, tetrakis(trimethylphosphine)nickel, dicarbonylbis(triethylphosphine)nickel, tricarbonyl(tributylphosphine)nickel, tricarbonyl(tri-*tert*-butylphosphine)nickel, [(1,2,5,6,9,10-η)-1,5,9-cyclododecatriene](trimethylphosphine)nickel, bis(cyclooctatetraene)nickel, bis(*tert*-butylisocyanide)(tetracyanoethylene)nickel, bis(norbornene)(trimethylphosphine)nickel, (1,5,9-cyclododecatriene)(triethylphosphine)nickel, [hexakis(trifluoromethyl)benzene](1,5-cyclooctadiene)nickel, azobenzene(1,5-cyclooctadiene)nickel, tris(norbornene)nickel, 1,5-cyclooctadiene)(diphenylacetylene)nickel, bis(ethylene)(triphenylphosphine)nickel, bis(ethylene)(tricyclohexylphosphine)nickel, (diphenylacetylene)bis(*tert*-butyl isocyanide)nickel, tetrakis(triethylphosphite-*P*)nickel, tetrakis(triethylphosphine)nickel, dicarbonylbis(methyldiphenylphosphine)nickel, tetrakis(isocyanocyclohexane)nickel, hexacarbonylbis[μ-(diphenylphosphino)]dinickel, [(1,2,5,6,9,10-η)-1,5,9-cyclododecatriene](triphenylphosphine)nickel, tetrakis(dimethylphenylphosphine)nickel, bis(tributylphosphine)(1,5-cyclooctadiene)nickel, (triphenylphosphine)bis(1,5-cyclooctadiene)nickel, tricyclohexylphosphine)bis(3-vinylcyclohexene)nickel, dicarbonylbis(triphenylarsine)nickel, dicarbonylbis(triphenylphosphine)nickel, dicarbonylbis(triphenylstibine)nickel, dicarbonyl(triphenylphosphine)(triphenylphosphite-*P*)nickel, dicarbonylbis(triphenylphosphite-*P*)nickel, (1,1-difluoroethylene)bis(triphenylphosphine)nickel, ethylenebis(triphenylphosphine)nickel, dicarbonylbis(tricyclohexylphosphine)nickel, ethylenebis(tricyclohexylphosphine)nickel, (dimethylacetylene)bis(triphenylphosphine)nickel, tetrakis(diethylphenylphosphonite-*P*)nickel, tetrakis(diethylphenylphosphine)nickel, [(2,3-η)-2-butene]bis(tricyclohexylphosphine)nickel, tris(stilbene)nickel, [(2,3-η)-dimethyl-2-butenedioate]bis(triphenylphosphine)nickel, styrenebis(triphenylphosphine)nickel, [(1,2,5,6-η)-1,5-cyclooctadiene]bis(triphenylphosphine)nickel, ethylenebis[tris(2-methylphenyl)phosphite-*P*]nickel, diphenylethylenebis(triphenylphosphine)nickel, tetrakis(methyldiphenylphosphinite-P)nickel, tetrakis(methyldiphenylphosphine)nickel,

tris(triphenylphosphine)nickel, carbonyltris(triphenylphosphine)nickel, carbonyltris(triphenylphosphite-*P*)nickel, tris[tris(4-methylphenyl)phosphine]nickel, tetrakis(triphenylarsine)nickel, tetrakis(triphenylphosphite-*P*)nickel, tetrakis(triphenylphosphine)nickel, bis(ethylene)nickel, bis(ethylene)trimethylphoshinenickel, (acetylene)bis(trimethylphosphine)nickel, (acetylene)bis(triphenylphosphine)nickel, (2-butyne)bis(triphenylphosphine)nickel, bis(triethylphosphine)(1,5-cyclooctadiene)nickel, cobalt carbonyl ($Co_2(CO)_8$, $Co_4(CO)_{12}$ and $Co_6(CO)_{16}$), cobalt tricarbonyl nitrosyl, cobalt powder, octacarbonyl[μ-(1,1,2,2-tetrafluoro-1,2-ethanediyl)]dicobalt, heptacarbonyl(trimethyl phosphite)dicobalt, nitrosylbis(*tert*-butyl isocyanide)carbonylcobalt, bis(1,3-butadiene)tetracarbonyldicobalt, hexacarbonyl(2,5-norbornadiene)dicobalt, μ-cyclooctynehexacarbonyldicobalt, pentacarbonyltris(trimethylphosphine)dicobalt, (η^6-benzene)nonacarbonyltetracobalt, tri-*tert*-butylisocyanidenitrosylcobalt, tetracarbonylbis(1,4-cyclohexadiene)dicobalt, di-μ-carbonyldicarbonylbis[(1,2,3,4-η)-2,3-dimethyl-1,3-butadiene]dicobalt, tetracarbonyltetrakis(trimethylphosphine)dicobalt, tetracarbonylbis(2,5-norbornadiene)dicobalt, nitrosyldicarbonyl(triphenylphosphine)cobalt, octacarbonyltetrakis(trimethyl phosphite-*P*)tetracobalt, heptacarbonyl(triphenylphosphine)dicobalt, undecacarbonyl(triphenylphosphine)tetracobalt, hexacarbonylbis(tributylphosphine)dicobalt, carbonylnitrosylbis(triphenylphosphine)cobalt, hexacarbonylbis(triphenylphosphine)dicobalt, hexacarbonylbis(triphenylphosphite)dicobalt, (ethylene)tris(triphenylphosphine)cobalt, tris(dicarbonyltriphenylphosphinecobalt), tetracarbonyltetrakis(triphenylphosphite)dicobalt, dicarbonylhexakis(triphenylphosphine)dicobalt, (1,5-cyclooctadiene)bis(trimethylphosphine)cobalt, cyclopentenebis(trimethylphosphine)cobalt, (2,5-norbornene)tris(trimethylphosphine)cobalt, nitrosyltris(triphenylphosphine)cobalt, iron carbonyl ($Fe(CO)_5$, $Fe_3(CO)_{12}$ and $Fe_2(CO)_9$), cyclohexadiene iron tricarbonyl, cyclooctatetrene iron tricarbonyl, iron powder, carbonyltetrakis(trifluorophosphine)iron, dicarbonyltris(trifluorophosphine)iron, dicarbonyldinitrosyliron, tricarbonylbis(trifluorophosphine)iron, acrylonitrileirontetrakis(trifluorophosphine), tetracarbonyl(trichlorophosphine)iron, tetracarbonyl(phosphine)iron, (η^4-1,3-butadiene)tris(trifluorophosphine)iron, bis(methyl isocyanide)dinitrosyliron, carbonyldinitrosyl(trimethyl phosphite-*P*)iron, (carbonothioyl)tetracarbonyliron, (carbon

disulfide)tetracarbonyliron, tetracarbonyl(tetrafluoroethylene)iron, (bromoethylene)tetracarbonyliron, (vinyl chloride)iron tetracarbonyl, tetracarbonyl(methyl isocyanide)iron, tetracarbonyl(ethylene)iron, (vinyl alcohol)iron tetracarbonyl, (η^6-benzene)bis(trifluorophosphine)iron, dinitrosylbis(trimethyl phosphite-*P*)iron, tricarbonyl(η^4-1,2-dichloro-1,3-butadiene)iron, tricarbonyl(η^4-1,4-dichloro-1,3-butadiene)iron, tricarbonyl(η^4-2,4-dichloro-1,3-butadiene)iron, (acrylic acid)tetracarbonyliron, tricarbonyl(η^4-1-bromo-1,3-butadiene)iron, tricarbonyl(η^4-2-bromo-1,3-butadiene)iron, tricarbonyl(η^4-1-chloro-1,3-butadiene)iron, tricarbonyl(η^4-2-chloro-1,3-butadiene)iron, tricarbonylbis(methyl isocyanide)iron, (η^4-1,3-butadiene)tricarbonyliron, tetracarbonyl(trimethylphosphine)iron, tetracarbonyl(trimethylamine)iron, tetracarbonyl(trimethylstibine)iron, tetracarbonyl(trimethyl phosphite-*P*)iron, tricarbonyl[(1,2,3,4-η)-1,3-cyclopentadiene]iron, [(1,2-η)-1,3-butadiene]tetracarbonyliron, tricarbonyl[(1,2,3,4-η)-2-methyl-1,3-cyclopentadiene]iron, bis(η^4-1,3-butadiene)(trifluorophosphine)iron, tricarbonyl(2,4-hexadienedinitrile)iron, tricarbonyl(1,2,3,4-η)-1,3-cyclohexadieneiron, tricarbonyl(1,2,3,4-η)-1,3,5-hexatrieneiron, tricarbonyl[(1,2,3,4-η)-2,3-dimethyl-1,3-butadiene]iron, tricarbonyl[(1,2,3,4-η)-1,3-hexadiene)]iron, tricarbonyl[(1,2,3,4-η)-2,4-hexadiene)]iron, tricarbonyl[(1,2,3,4-η)-2-methyl-1,3-pentadiene)]iron, tricarbonyl[(1,2,3,4-η)-3-methyl-1,3-pentadiene)]iron, tricarbonyl[(1,2,3,4-η)-4-methyl-1,3-pentadiene)]iron, tricarbonylbis(trimethylphosphine)iron, tricarbonylbis(trimethylstibine)iron, tricarbonylbis(trimethyl phosphite-*P*)iron, tetracarbonyl[tetrakis(trifluoromethyl)ethylene]iron, tricarbonyl(tropone)iron, tricarbonyl(4,6-cycloheptadiene-1,3-dione)iron, tricarbonyl(2,5-norbornadiene)iron, cycloheptatrieneiron tricarbonyl, tricarbonyl(spiro[2.4]hepta-4,6-diene)iron, (η^4-cyclooctatetraene)tricarbonyliron, tricarbonyl(5,6-dimethylene-1,3-cyclohexadiene)iron, tricarbonyl[(1,2,3,4-η)-1,3-cyclooctadiene]iron, tricarbonyl[(1,2,5,6-η)-1,5-cyclooctadieneiron, tricarbonylbis(methyl acrylate)iron, (η^4-1,3-butadiene)(η^6-toluene)iron, (η^4-1,3-butadiene)carbonyl[(1,2,3,4-η)-1,3,5,7-cyclooctatetraene]iron, (η^4-1,3-butadiene)tris(trimethylphosphine)iron, (η^4-1,3-butadiene)tris(trimethyl phosphite-*P*)iron, hexacarbonyl[μ-(1,2,3,4-η:5,6,7,8-η)-1,3,5,7-cyclooctatetraene]]diiron, (η^6-benzene[(1,2,3,4-η)-1,3,5,7-cyclooctatetraene]iron, tricarbonylbis(triethylphosphine)iron,

tricarbonylbis(triethyl phosphite-*P*)iron, bis[1,2,5,6-η)-1,5-cyclooctadiene]iron, , (η^6-hexamethylbenzene)[(1,2,3,4-η)-1,3,5,7-cyclooctatetraene]iron, , (η^6-hexamethylbenzene)[1,2,5,6-η)-1,5-cyclooctadiene]iron, bis(η^6-hexamethylbenzene)iron, bis(1,3-butadiene)trimethylphosphineiron, (1,5-cyclooctadiene)tricarbonyliron, copper powder, copper carbonyl (CuCO, $Cu(CO)_2$ and $Cu(CO)_3$), palladium powder, bis(tri-*tert*-butylphosphine)palladium, bis(tricyclohexylphosphine)palladium, tetrakis(triphenylphosphine)palladium, tris(dibenzylideneacetone)dipalladium, palladium carbonyl ($Pd(CO)_4$), dicarbonyl(hexafluoro-2-butyne)palladium, tris(ethylene)palladium, bis(*tert*-butylisocyanide)palladium, bis(phenylisocyanide)palladium, bis(cyclohexylisocyanide)palladium, bis(1,5-cyclooctadiene)palladium, [bis(trifluoromethyl)acetylene]bis(dimethylphenylphosphine)palladium, bis(tri-*tert*-butylphosphine)palladium, tetrakis(triethylphosphite-*P*)palladium, bis(dibenzylideneacetone)palladium, bis(methyldiphenylphosphine)(styrene)palladium, ethylenebis(triphenylphosphine)palladium, ethylenebis(tricyclohexylphosphine)palladium, bis(triphenylphosphine)hexafluoro-2-butynepalladium, 9maleic anhydride)bis(triphenylphosphine)palladium, ethylenebis([tris(2-methylphenyl)phosphite-*P*]palladium, tris(dibenzylideneacetone)palladium, tris(μ-dibenzylideneacetone)dipalladium, carbonyltris(triphenylphosphine)palladium, tetrakis(triphenylarsine)palladium, bis(triphenylphosphine)bis(triphenylplumbyl)palladium, tetrakis(triphenylstibine)palladium, tetrakis(trifluorophosphine)palladium, platinum powder, tetrakis(trifluorophosphine)platinum, tetrakis(triphenylphosphine)platinum, platinum tetracarbonyl, tris(ethylene)platinum, bis(ethylene)(trimethylphosphine)platinum, ethylenebis(trimethylphosphine)platinum, dimethylbis(trimethylarsine)platinum, hexafluoro-2-butyne(1,5-cyclooctadiene)platinum, dicarbonylbis(triethylphosphine)platinum, ethylenebis(triethylphosphine)platinum, bis(1,5-cycloocadiene)platinum, bis(triethylphosphine)hexafluoro-2-butyneplatinum, bis(dimethylphenylphosphine)(tetrafluoroethylene)platinum, tris(triethylphosphine)platinum, carbonyltris(triethylphosphine)platinum, diphenylacetylene)bis(trimethylphosphine)platinum, bis(ethylene)(triphenylphosphine)platinum, bis(ethylene)(triphenylarsine)platinum, bis(ethylene)(tricyclohexylphosphine)platinum, bis(tris-*tert*-butylphosphine)platinum, tetrakis(triethylphosphite-*P*)platinum, tetrakis(triethylphosphine)platinum, tris(tri-*iso*-propylphosphine)platinum, bis(diphenylacetylene)platinum,

bis(dibenzylideneacetone)platinum, bis(tricyclohexylphosphine)platinum, (carbon oxysulfide)bis(triphenylphosphine)platinum, (carbon disulfide-C,S)bis(triphenylphosphine)platinum, bis(triphenylphosphine)(carbon diselenide)platinum, (trifluoroacetonitrile)bis(triphenylphosphine)platinum, (tetrafluoroethylene)bis(triphenylphosphine)platinum, dicarbonylbis(triphenylphosphine)platinum, acetylenebis(triphenylphosphine)platinum, ethylenebis(triphenylphosphine)platinum, [(1,2-η)-cyclohexyne]bis(triphenylphosphine)platinum, [(1,2-η)-cycloheptyne]bis(triphenylphosphine)platinum, [(1,2-η)-cyclooctyne]bis(triphenylphosphine)platinum, diphenylacetylenebis(triphenylphosphine)platinum, silver powder, silver carbonyl (AgCO, $Ag(CO)_2$ and $Ag(CO)_3$), gold powder, gold carbonyl (AuCO and $Au(CO)_2$), ruthenium powder, ruthenium carbonyl ($Ru_3(CO)_{12}$ and $Ru(CO)_5$), tricarbonylbis(triphenylphosphine)ruthenium, rhodium powder, rhenium powder, rhenium carbonyl ($Re_2(CO)_{10}$), osmium powder, osmium carbonyl ($Os_3(CO)_{12}$ and $Os(CO)_5$), iridium powder, iridium carbonyl ($Ir_4(CO)_{12}$), and the like.

Preferred zero formal oxidation state transition metals or transition metal complexes include nickel carbonyl ($Ni(CO)_4$), bis(1,5-cyclooctadiene) nickel, tris(ethylene)nickel, bis(cyclooctatetraene)nickel, tris(norbornene)nickel, (1,5-cyclooctadiene)(diphenylacetylene)nickel, nickel powder, cobalt carbonyl ($Co_2(CO)_8$ $Co_4(CO)_{12}$ and $Co_6(CO)_{16}$), cobalt tricarbonyl nitrosyl, bis(1,3-butadiene)tetracarbonyldicobalt, hexacarbonyl(2,5-norbornadiene)dicobalt, (η^6-benzene)nonacarbonyltetracobalt, cobalt powder, iron carbonyl ($Fe(CO)_5$, $Fe_3(CO)_{12}$ and $Fe_2(CO)_9$), cyclohexadiene iron tricarbonyl, cyclooctatetrene iron tricarbonyl, tetracarbonyl(ethylene)iron, iron powder, copper powder, copper carbonyl (CuCO, $Cu(CO)_2$ and $Cu(CO)_3$), palladium powder, tris(dibenzylideneacetone)dipalladium, palladium carbonyl ($Pd(CO)_4$), tris(ethylene)palladium, bis(1,5-cyclooctadiene)palladium, platinum powder, platinum tetracarbonyl, tris(ethylene)platinum, silver powder, silver carbonyl (AgCO, $Ag(CO)_2$ and $Ag(CO)_3$), gold power, gold carbonyl (AuCO and $Au(CO)_2$), ruthenium powder, ruthenium carbonyl ($Ru_3(CO)_{12}$ and $Ru(CO)_5$), rhodium powder, rhenium powder, rhenium carbonyl ($Re_2(CO)_{10}$), osmium power, osmium carbonyl ($Os_3(CO)_{12}$ and $Os(CO)_5$), iridium powder, iridium carbonyl ($Ir_4(CO)_{12}$), and the like.

Most preferred zero formal oxidation state transition metals or transition metal complexes include nickel carbonyl ($Ni(CO)_4$), bis(1,5-cyclooctadiene) nickel, nickel powder, cobalt carbonyl ($Co_2(CO)_8$ $Co_4(CO)_{12}$ and $Co_6(CO)_{16}$), cobalt tricarbonyl nitrosyl, cobalt powder, iron carbonyl ($Fe(CO)_5$, $Fe_3(CO)_{12}$ and $Fe_2(CO)_9$), cyclohexadiene iron tricarbonyl, cyclooctatetrene iron tricarbonyl, iron powder, copper powder, copper carbonyl (CuCO, $Cu(CO)_2$ and $Cu(CO)_3$), palladium powder, tris(dibenzylideneacetone)dipalladium, palladium carbonyl ($Pd(CO)_4$), platinum powder, platinum tetracarbonyl, silver powder, silver carbonyl (AgCO, $Ag(CO)_2$ and $Ag(CO)_3$), gold power, gold carbonyl (AuCO and $Au(CO)_2$), ruthenium powder, ruthenium carbonyl ($Ru_3(CO)_{12}$ and $Ru(CO)_5$), rhodium powder, rhenium powder, rhenium carbonyl ($Re_2(CO)_{10}$), osmium power, osmium carbonyl ($Os_3(CO)_{12}$ and $Os(CO)_5$), iridium powder, iridium carbonyl ($Ir_4(CO)_{12}$), and the like.

Substituted or unsubstituted 1,2-benzoquinones may be used. Preferred 1,2-benzoquinones include 3,6-di-*tert*-butyl-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-chloro-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-dichloro-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-bromo-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-dibromo-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-fluoro-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-difluoro-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-methoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-dimethoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-ethoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-diethoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-propoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-dipropoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-butoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-dibutoxy-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-*iso*-propyl-1,2-benzoquinone, 3,6-di-*tert*-butyl-4,5-di-*iso*-propyl-1,2-benzoquinone, 3,6-di-*tert*-butyl-4-cyclohexyl-1,2-benzoquinone, 3,5-di-*tert*-butyl-1,2-benzoquinone, 3,5-di-*tert*-butyl-6-chloro-1,2-benzoquinone, 3,5-di-*tert*-butyl-6-bromo-1,2-benzoquinone, 3,5-di-*tert*-butyl-6-fluoro-1,2-benzoquinone, 3,5-di-*tert*-butyl-6-nitro-1,2-benzoquinone, 3,4,6-tri-*iso*-propyl-1,2-benzoquinone, 3,4,5,6-tetra-*iso*-propyl-1,2-benzoquinone 3,6-di-*iso*-propyl-1,2-benzoquinone, 1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-dione, 1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-dione, 1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-dione, 3,6-di-*n*-butyl-1,2-benzoquinone, 3,6-di-*n*-butyl-4-chloro-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-dichloro-1,2-benzoquinone, 3,6-di-*n*-butyl-4-bromo-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-dibromo-1,2-benzoquinone, 3,6-di-*n*-butyl-4-fluoro-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-difluoro-1,2-benzoquinone, 3,6-di-*n*-butyl-4-methoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-dimethoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4-ethoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-diethoxy-1,2-benzoquinone, 3,6-di-*n*-

butyl-4-propoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-dipropoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4-butoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-dibutoxy-1,2-benzoquinone, 3,6-di-*n*-butyl-4-*iso*-propyl-1,2-benzoquinone, 3,6-di-*n*-butyl-4,5-di-*iso*-propyl-1,2-benzoquinone, 3,6-di-*n*-butyl-4-cyclohexyl-1,2-benzoquinone, 3,5-di-*n*-butyl-1,2-benzoquinone, 3,5-di-*n*-butyl-6-chloro-1,2-benzoquinone, 3,5-di-*n*-butyl-6-bromo-1,2-benzoquinone, 3,5-di-*n*-butyl-6-fluoro-1,2-benzoquinone, 3,5-di-*n*-butyl-6-nitro-1,2-benzoquinone, 1,4,6,8-tetra-*n*-butyldibenzo[1,4]dioxine-2,3-dione, 3,6-di-*iso*-butyl-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-chloro-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-dichloro-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-bromo-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-dibromo-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-fluoro-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-difluoro-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-methoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-dimethoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-ethoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-diethoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-propoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-dipropoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-butoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-dibutoxy-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-*iso*-propyl-1,2-benzoquinone, 3,6-di-*iso*-butyl-4,5-di-*iso*-propyl-1,2-benzoquinone, 3,6-di-*iso*-butyl-4-cyclohexyl-1,2-benzoquinone, 3,5-di-*iso*-butyl-1,2-benzoquinone, 3,5-di-*iso*-butyl-6-chloro-1,2-benzoquinone, 3,5-di-*iso*-butyl-6-bromo-1,2-benzoquinone, 3,5-di-*iso*-butyl-6-fluoro-1,2-benzoquinone, 3,5-di-*iso*-butyl-6-nitro-1,2-benzoquinone, 1,4,6,8-tetra-*iso*-butyldibenzo[1,4]dioxine-2,3-dione, 3,6-di-*iso*-propyl-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-chloro-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-dichloro-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-bromo-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-dibromo-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-fluoro-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-difluoro-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-methoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-dimethoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-ethoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-diethoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-propoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-dipropoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-butoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4,5-dibutoxy-1,2-benzoquinone, 3,6-di-*iso*-propyl-4-cyclohexyl-1,2-benzoquinone, 3,5-di-*iso*-propyl-1,2-benzoquinone, 3,5-di-*iso*-propyl-6-chloro-1,2-benzoquinone, 3,5-di-*iso*-propyl-6-bromo-1,2-benzoquinone, 3,5-di-*iso*-propyl-6-fluoro-1,2-benzoquinone, 3,5-di-*iso*-propyl-6-nitro-1,2-benzoquinone, 1,4,6,8-tetra-*iso*-propyldibenzo[1,4]dioxine-2,3-dione, 3,6-dimethyl-1,2-benzoquinone, 3,6-dimethyl-4-chloro-1,2-benzoquinone, 3,6-dimethyl-4,5-dichloro-1,2-benzoquinone, 3,6-dimethyl-4-bromo-1,2-benzoquinone, 3,6-dimethyl-4,5-dibromo-1,2-benzoquinone, 3,6-dimethyl-4-

fluoro-1,2-benzoquinone, 3,6-dimethyl-4,5-difluoro-1,2-benzoquinone, 3,6-dimethyl-4-methoxy-1,2-benzoquinone, 3,6-dimethyl-4,5-dimethoxy-1,2-benzoquinone, 3,6-dimethyl-4-ethoxy-1,2-benzoquinone, 3,6-dimethyl-4,5-diethoxy-1,2-benzoquinone, 3,6-dimethyl-4-propoxy-1,2-benzoquinone, 3,6-dimethyl-4,5-dipropoxy-1,2-benzoquinone, 3,6-dimethyl-4-butoxy-1,2-benzoquinone, 3,6-dimethyl-4,5-dibutoxy-1,2-benzoquinone, 3,6-dimethyl-4-*iso*-propyl-1,2-benzoquinone, 3,6-dimethyl-4,5-di-*iso*-propyl-1,2-benzoquinone, 3,6-dimethyl-4-cyclohexyl-1,2-benzoquinone, 3,5-dimethyl-1,2-benzoquinone, 3,5-dimethyl-6-chloro-1,2-benzoquinone, 3,5-dimethyl-6-bromo-1,2-benzoquinone, 3,5-dimethyl-6-fluoro-1,2-benzoquinone, 3,5-dimethyl-6-nitro-1,2-benzoquinone, 1,4,6,8-tetramethyldibenzo[1,4]dioxine-2,3-dione, 3,6-di-*n*-propyl-1,2-benzoquinone, 3,5-di-*n*-propyl-1,2-benzoquinone, naphthalene-2,3-dione, phenanthrene-9,10-dione, 3,4,5,6-tetrachloro-1,2-benzoquinone, 3,6-dichloro-1,2-benzoquinone, and 4-methyl-1,2-benzoquinone.

Preferred bidentate and tridentate chelating ligands are those of formulae L*1 to L*410, inclusive. Most preferred bidentate and tridentate chelating ligands are selected from the group IOTA-LIGANDS which defined to be:

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene)],

[1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],
[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],
[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene],
[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine],
[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane],
[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine],

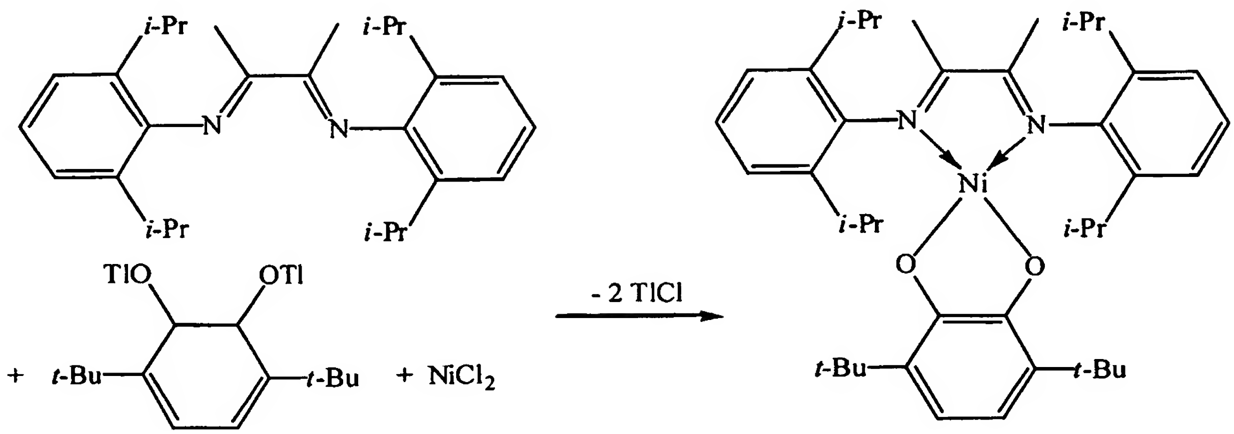
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,6-pyrazinediyldiethylidyne)bis[2,4,6-triethylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,6-pyrimidinediyldiethylidyne)bis[2,4,6-triethylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine],

N,N'-(2,6-[1,3,5]triazinediyldiethylidyne)bis[2,4,6-triethylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,5-furandiyldiethylidyne)bis[2,4,6-triethylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,4,6-trimethylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2-methylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,6-dimethylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,4-dimethylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2-*iso*-propyl-benzenamine],
N,N'-(2,5-thiophenediyldiethylidyne)bis[2,4,6-triethylbenzenamine],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine]
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine], and
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine].

A second method of preparation uses a metal halide, a bidentate or tridentate chelating ligand, and a salt of a 1,2-catecholate complex, such as a dithallium 1,2-catecholate, to from the complex of the invention. An example of this reaction is illustrated below:



Metal halides that may be used include nickel (II) chloride, nickel (II) bromide, nickel (II) iodide, nickel (II) bromide ethylene glycol dimethyl ether complex, nickel (II) bromide 2-methoxyethylether complex, nickel (II) fluoride, bis(triphenylphosphine)nickel(II) bromide, bis(triphenylphosphine)nickel(II) chloride, dichlorobis(triethylphosphine)nickel, dibromo(carbonyl)bis(triethylphosphine)nickel, dibromo(1,2,3,4,5,6,7,8,9,10,11,12-dodecahydrocyclobuta[1,2:3,4]dicyclooctanenickel, chlorobis(trimethylphosphine)tricarbonylnickel, cobalt (II) chloride, cobalt (II) bromide, cobalt (II) iodide, cobalt (II) fluoride, dibromotetrakis(methyl isocyanide)cobalt, diiodotetrakis(methyl isocyanide)cobalt, bromotricarbonyl(triethylphosphine)cobalt, chlorotricarbonyl(triethylphosphine)cobalt, carbonylchlorotris(trimethylphosphine)cobalt, carbonyliodotris(trimethylphosphine)cobalt, tricarbonyliodo(triphenylphosphine)cobalt, dibromotetrakis(phenyl isocyanide)cobalt, diiodotetrakis(phenyl isocyanide)cobalt, dicarbonylchlorobis(triphenylphosphine)cobalt, dicarbonyliodobis(triphenylphosphine)cobalt, chlorotris(triphenylphosphine)cobalt, iron (II) bromide, iron (II) chloride, iron (II) fluoride, iron (II) iodide, bromotrinitrosyliron, dicarbonyldichloroiron, dibromotetracarbonyliron, dichlorotetracarbonyliron, diiodotetracarbonyliron, bis(tricarbonyliron bromide), bis(tricarbonyliron iodide), dicarbonyldiiodobis(methyl isocyanide)iron, tricarbonyldiiodo(trimethylphosphine)iron, dichlorobis(trimethylphosphine)iron, dichlorodicarbonylbis(trimethylphosphine)iron, diiododicarbonylbis(trimethylphosphine)iron, copper (I) bromide, copper (II) bromide, copper (I) chloride, copper (II) chloride, copper (II) fluoride, copper(I) iodide, dichloro-μ-1,4-butadienedicopper, iodo(triethyl phosphite-*P*)copper, chlorotricarbonyl[(1,2,5,6-η)-1,5-cyclooctadiene]copper, dichlorobis(acetonitrile)palladium (II),

dichlorobis(benzonitrile)palladium(II), dichlorobis(tricyclohexylphosphine)palladium (II), dichlorobis(triphenylphosphine)palladium (II), dichlorobis(tri-o-tolylphosphine)palladium (II), dichloro(1,5-cyclooctadiene)palladium (II), dichlorodiamine palladium (II), palladium (II) bromide, palladium (II) chloride, palladium (II) iodide, dicarbonyldichloropalladium, dichlorobis(ethylene)palladium, dichloro[(1,2,5,6-η)-1,5-hexadiene]palladium, dibromo(norbornadiene)palladium, dichloro(norbornadiene)palladium, cyclooctatetraenepalladium dichloride, (1,5-cyclooctadiene)dibromopalladium, (1,5-cyclooctadiene)dichloropalladium, dichloro(dicyclopentadiene)palladium, (pentamethylcyclopentadiene)dichloropalladium, bis(*tert*-butylisocyanide)diiodopalladium, dichloro[hexamethyl(dewar benzene)]palladium, bis(benzonitrile)palladium dichloride, dichlorobis(phenyl isocyanide)palladium, dichlorobis(cyclohexylisocyanide)palladium, dichloro(phenylisocyanide)(triphenylarsine)palladium, dichloro(phenylisocyanide)(triphenylphosphine)palladium, dibromo(1,5-cyclooctadiene)platinum (II), dichlorobis(benzonitrile)platinum (II), dichlorobis(diethylsulfide)platinum (II), dichlorobis(pyridine)platinum (II), dichlorobis(triethylphosphine)platinum (II), dichlorobis(triphenylphosphine)platinum (II), dichloro(1,5-cyclooctadiene)platinum (II), dichlorodiamine platinum (II), di-μ-chloro-dichlorobis(ethylene)diplatinum (II), dichloro(dicyclopentadienyl)platinum (II), diiodo(1,5-cyclooctadiene)platinum (II), platinum (II) bromide, platinum (II) chloride, platinum (II) iodide, dibromodicarbonylplatinum, dicarbonyldichloroplatinum, dicarbonyldiiodoplatinum, bis(acetonitrile)dichloroplatinum, dichlorobis(ethylene)platinum, dichloro(ethylene)(dimethylamine)platinum, dichloro[(1,2,5,6-η)-1,5-hexadiene]platinum, dibromo(2,5-norbornadiene)platinum, dichloro(2,5-norbornadiene)platinum, diiodo(2,5-norbornadiene)platinum, dichloro(ethylene)(pyridine)platinum, dichlorocarbonyl(triethylphosphine)platinum, cyclooctatetraeneplatinum dichloride, cyclooctatetraeneplatinum dibromide, cyclooctatetraeneplatinum diiodide, , diiodo(1,5-cyclooctadiene)platinum, dichloro(methylisocyanide)(triethylphosphine)platinum, carbonyldichloro(dimethylphenylphosphine)platinum, dibromo(dicyclopentadienyl)platinum, (pentamethylcyclopentadiene)dichloroplatinum, dibromo(hexamethyldewar benzene)platinum, dichloro(hexamethyldewar benzene)platinum, diiodo(hexamethyldewar benzene)platinum, dichloro(phenylisocyanide)(triethylphosphine)platinum, bis(benzonitrile)dichloroplatinum, carbonyldichloro(tricyclohexylphosphine)platinum,

dichloro(methyl isocyanide)(triphenylphosphine)platinum, dichloro(ethylene)(triphenylphosphine)platinum, dichlorobis(tributylphosphine)platinum, dichloro(phenyl isocyanide)(triphenylphosphine)platinum, silver (I) chloride, silver (I) bromide, silver (I) iodide, silver (I) fluoride, silver (II) fluoride, chlorocarbonyl gold (I), chlorotriethylphosphine gold (I), chlorotrimethylphosphine gold (I), chlorotriphenylphosphine gold (I), gold (I) chloride, gold (I) iodide, chlorotricyclohexylphosphine gold, chlorocyclooctene gold, dichloro(benzene)ruthenium (II) dimer, dichloro(1,5-cyclooctadiene)ruthenium (II), dichlorodicarbonylbis(triphenylphosphine)ruthenium (II), dichlorotricarbonylruthenium (II) dimer, dichlorotris(triphenylphosphine)ruthenium (II), chlorotris(triphenylphosphine)ruthenium, dichlorotris(triphenylphosphine)osmium, rhenium pentacarbonyl bromide, rhenium pentacarbonyl chloride, chlorocarbonylbis(triphenylphosphine)iridium (I), chloro-1,5-cyclooctadiene iridium (I) dimer, chlorotricarbonyliridium (I), and the like. Pseudo metal halides such as metal triflates may be used in place of the metal halide.

Most preferred metal halides are nickel (II) chloride, nickel (II) bromide, nickel (II) bromide ethylene glycol dimethyl ether complex, nickel (II) bromide 2-methoxyethylether complex, cobalt (II) chloride, cobalt (II) bromide, bromotricarbonyl(triethylphosphine)cobalt, chlorotricarbonyl(triethylphosphine)cobalt, carbonylchlorotris(trimethylphosphine)cobalt, iron (II) bromide, iron (II) chloride, bromotrinitrosyliron, dicarbonyldichloroiron, dibromotetracarbonyliron, dichlorotetracarbonyliron, copper (I) bromide, copper (II) bromide, copper (I) chloride, copper (II) chloride, dichloro-μ-1,4-butadienedicopper, chlorotricarbonyl[(1,2,5,6-η)-1,5-cyclooctadiene]copper, dichloro(1,5-cyclooctadiene)palladium (II), dichlorodiamine palladium (II), palladium (II) bromide, palladium (II) chloride, dicarbonyldichloropalladium, dichlorobis(ethylene)palladium, dibromo(norbornadiene)palladium, dichloro(norbornadiene)palladium, cyclooctatetraenepalladium dichloride, (1,5-cyclooctadiene)dibromopalladium, (1,5-cyclooctadiene)dichloropalladium, dichloro(dicyclopentadiene)palladium, dibromo(1,5-cyclooctadiene)platinum (II), dichlorobis(pyridine)platinum (II), dichloro(1,5-cyclooctadiene)platinum (II), dichlorodiamine platinum (II), di-μ-chloro-dichlorobis(ethylene)diplatinum (II), dichloro(dicyclopentadienyl)platinum (II), platinum (II) bromide, platinum (II) chloride, dibromodicarbonylplatinum, dicarbonyldichloroplatinum,

dichlorobis(ethylene)platinum, dichloro(ethylene)(dimethylamine)platinum, dibromo(2,5-norbornadiene)platinum, dichloro(2,5-norbornadiene)platinum, silver (I) chloride, silver (I) bromide, chlorocarbonyl gold (I), chlorotrimethylphosphine gold (I), gold (I) chloride, chlorocyclooctene gold, dichloro(benzene)ruthenium (II) dimer, dichloro(1,5-cyclooctadiene)ruthenium (II), dichlorotricarbonylruthenium (II) dimer, dichlorotris(triphenylphosphine)osmium, rhenium pentacarbonyl bromide, rhenium pentacarbonyl chloride, chloro-1,5-cyclooctadiene iridium (I) dimer, chlorotricarbonyliridium (I), and the like.

Even more preferred are nickel (II) chloride, nickel (II) bromide, nickel (II) bromide ethylene glycol dimethyl ether complex, nickel (II) bromide 2-methoxyethylether complex, cobalt (II) chloride, cobalt (II) bromide, iron (II) bromide, iron (II) chloride.

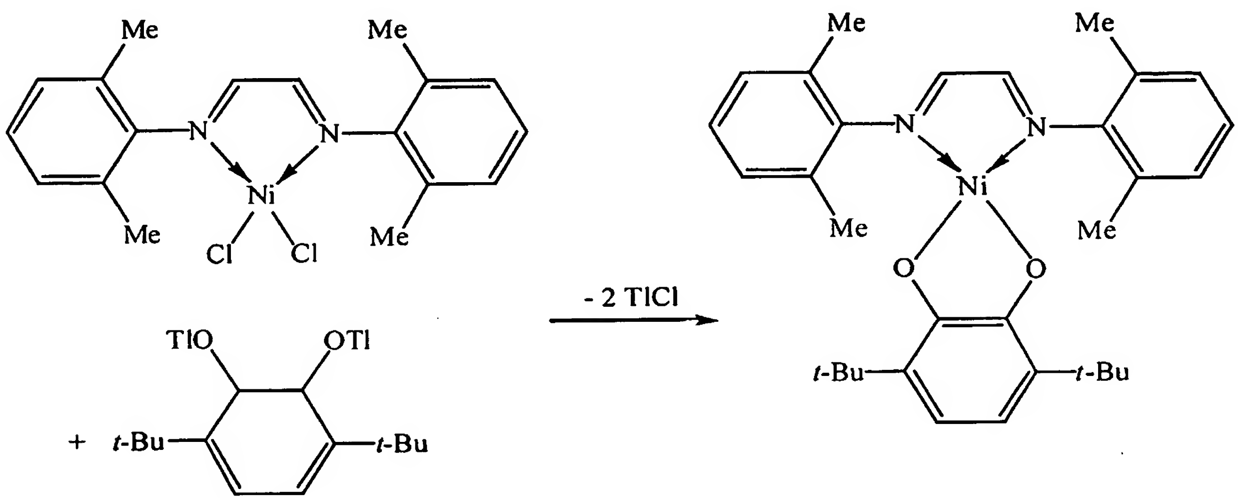
Catecholate salts that may be used include dithallium catecholate, Group 1 catecholate salts such as a disodium catecholate or a dipotassium catecholate, and Group 2 catecholate salts such as magnesium catecholate. Grignard type reagents such as di(magnesiumbromide)catecholate, may also be used. Preferred catecholate salts include the salts of 3,6-di-*tert*-butylcatecholate, 3,6-di-*tert*-butyl-4-chlorocatecholate, 3,6-di-*tert*-butyl-4,5-dichlorocatecholate, 3,6-di-*tert*-butyl-4-bromocatecholate, 3,6-di-*tert*-butyl-4,5-dibromocatecholate, 3,6-di-*tert*-butyl-4-fluorocatecholate, 3,6-di-*tert*-butyl-4,5-difluorocatecholate, 3,6-di-*tert*-butyl-4-methoxycatecholate, 3,6-di-*tert*-butyl-4,5-dimethoxycatecholate, 3,6-di-*tert*-butyl-4-ethoxycatecholate, 3,6-di-*tert*-butyl-4,5-diethoxycatecholate, 3,6-di-*tert*-butyl-4-propoxycatecholate, 3,6-di-*tert*-butyl-4,5-dipropoxycatecholate, 3,6-di-*tert*-butyl-4-butoxycatecholate, 3,6-di-*tert*-butyl-4,5-dibutoxycatecholate, 3,6-di-*tert*-butyl-4-*iso*-propylcatecholate, 3,6-di-tert-butyl-4,5-di-*iso*-propylcatecholate, 3,6-di-*tert*-butyl-4-cyclohexylcatecholate, 3,5-di-*tert*-butylcatecholate, 3,5-di-*tert*-butyl-6-chlorocatecholate, 3,5-di-*tert*-butyl-6-bromocatecholate, 3,5-di-*tert*-butyl-6-fluorocatecholate, 3,5-di-*tert*-butyl-6-nitrocatecholate, 3,4,6-tri-*iso*-propylcatecholate, 3,4,5,6-tetra-*iso*-propylcatecholate, 3,6-di-*iso*-propylcatecholate, 1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate, 1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate, 1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate, 3,6-di-*n*-butylcatecholate, 3,6-di-*n*-butyl-4-chlorocatecholate, 3,6-di-*n*-butyl-4,5-dichlorocatecholate,3,6-di-*n*-butyl-4-bromocatecholate, 3,6-di-*n*-butyl-4,5-dibromocatecholate, 3,6-di-*n*-butyl-4-fluorocatecholate,3,6-di-*n*-butyl-4,5-difluorocatecholate, 3,6-di-*n*-butyl-4-methoxycatecholate,3,6-di-*n*-butyl-4,5-dimethoxycatecholate, 3,6-di-*n*-butyl-4-

ethoxycatecholate, 3,6-di-*n*-butyl-4,5-diethoxycatecholate, 3,6-di-*n*-butyl-4-propoxycatecholate, 3,6-di-*n*-butyl-4,5-dipropoxycatecholate, 3,6-di-*n*-butyl-4-butoxycatecholate, 3,6-di-*n*-butyl-4,5-dibutoxycatecholate, 3,6-di-*n*-butyl-4-*iso*-propylcatecholate, 3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate, 3,6-di-*n*-butyl-4-cyclohexylcatecholate, 3,5-di-*n*-butylcatecholate, 3,5-di-*n*-butyl-6-chlorocatecholate, 3,5-di-*n*-butyl-6-bromocatecholate, 3,5-di-*n*-butyl-6-fluorocatecholate, 3,5-di-*n*-butyl-6-nitrocatecholate, 3,6-di-*iso*-butylcatecholate, 3,6-di-*iso*-butyl-4-chlorocatecholate, 3,6-di-*iso*-butyl-4,5-dichlorocatecholate,3,6-di-*iso*-butyl-4-bromocatecholate, 3,6-di-*iso*-butyl-4,5-dibromocatecholate, 3,6-di-*iso*-butyl-4-fluorocatecholate, 3,6-di-*iso*-butyl-4,5-difluorocatecholate, 3,6-di-*iso*-butyl-4-methoxycatecholate, 3,6-di-*iso*-butyl-4,5-dimethoxycatecholate, 3,6-di-*iso*-butyl-4-ethoxycatecholate, 3,6-di-*iso*-butyl-4,5-diethoxycatecholate, 3,6-di-*iso*-butyl-4-propoxycatecholate, 3,6-di-*iso*-butyl-4,5-dipropoxycatecholate, 3,6-di-*iso*-butyl-4-butoxycatecholate, 3,6-di-*iso*-butyl-4,5-dibutoxycatecholate, 3,6-di-*iso*-butyl-4-*iso*-propylcatecholate, 3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate, 3,6-di-*iso*-butyl-4-cyclohexylcatecholate, 3,5-di-*iso*-butylcatecholate, 3,5-di-*iso*-butyl-6-chlorocatecholate, 3,5-di-*iso*-butyl-6-bromocatecholate, 3,5-di-*iso*-butyl-6-fluorocatecholate, 3,5-di-*iso*-butyl-6-nitrocatecholate, 3,4,6-tri-*n*-propylcatecholate, 3,6-di-*iso*-propyl-4-chlorocatecholate, 3,6-di-*iso*-propyl-4,5-dichlorocatecholate, 3,6-di-*iso*-propyl-4-bromocatecholate, 3,6-di-*iso*-propyl-4,5-dibromocatecholate, 3,6-di-*iso*-propyl-4-fluorocatecholate, 3,6-di-*iso*-propyl-4,5-difluorocatecholate, 3,6-di-*iso*-propyl-4-methyoxycatecholate, 3,6-di-*iso*-propyl-4,5-dimethoxycatecholate, 3,6-di-*iso*-propyl-4-ethyoxycatecholate, 3,6-di-*iso*-propyl-4,5-diethoxycatecholate, 3,6-di-*iso*-propyl-4-propoxycatecholate, 3,6-di-*iso*-propyl-4,5-dipropoxycatecholate, 3,6-di-*iso*-propyl-4-butoxycatecholate, 3,6-di-*iso*-propyl-4,5-dibutoxycatecholate, 3,6-di-*iso*-propyl-4-cyclohexylcatecholate, 3,6-dimethyl-4-chlorocatecholate, 3,6-dimethyl-4,5-dichlorocatecholate, 3,6-di*iso*-propyl-4-bromocatecholate, 3,6-dimethyl-4,5-dibromocatecholate, 3,6-dimethyl-4-fluorocatecholate, 3,6-dimethyl-4,5-difluorocatecholate, 3,6-dimethyl-4-methyoxycatecholate, 3,6-dimethyl-4,5-dimethoxycatecholate, 3,6-dimethyl-4-ethyoxycatecholate, 3,6-dimethyl-4,5-diethoxycatecholate, 3,6-dimethyl-4-propoxycatecholate, 3,6-dimethyl-4,5-dipropoxycatecholate, 3,6-dimethyl-4-butoxycatecholate, 3,6-dimethyl-4,5-dibutoxycatecholate, 3,5-di-*iso*-propylcatecholate, 3,6-di-*n*-propylcatecholate, 3,5-di-*n*-propylcatecholate, 3,6-dimethylcatecholate, 3,5-

dimethylcatecholate, naphthalene-2,3-diolate, phenanthrene-9,10-diolate, 3,4,5,6-tetrachlorocatecholate, 3,6-dichlorocatecholate, and 4-methylcatecholate.

Preferred bidentate and tridentate chelating ligands are the same as those described above for the first method of preparation.

The third method of preparation requires the use of the bidentate or tridentate chelated metal halide with a salt of a 1,2-catecholate complex, such as a dithallium 1,2-catecholate, to from the complex of the invention. This reaction is illustrated below:



Preferred catecholate salts are the same as those listed above for the second method of preparation. Preferred bidentate or tridentate chelated metal halides are the nickel dihalides, palladium dihalides, cobalt dihalides, cobalt halides, iron dihalides, copper halides, copper dihalides, platinum dihalides, silver halides, silver dihalides, ruthenium dihalides, rhenium halides, osmium dihalides and iridium halides of the bidentate and tridentate chelating ligands listed above for the first method of preparation. For example, the metal halides of the bidentate chelating ligand, [1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene], would include:

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] palladium dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] cobalt dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] cobalt chloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] iron dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] copper chloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] copper dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] platinum dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] silver chloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] silver dichloride,

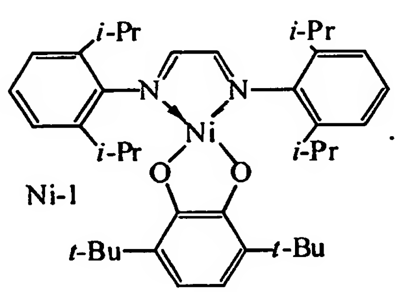
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] ruthenium dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] rhenium chloride,

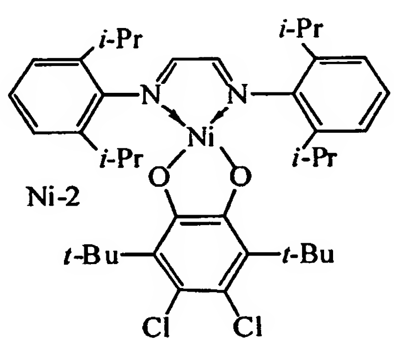
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] osmium dichloride,

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] iridium chloride, and similar compounds where "chloride" can be replaced with bromide, fluoride, and iodide. Most preferred bidentate or tridentate chelated metal halides are the nickel dihalides, palladium dihalides, cobalt dihalides, cobalt halides, and iron dihalides.

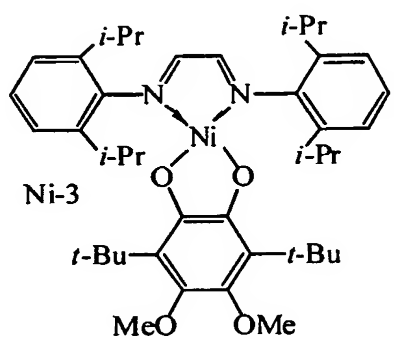
The following compounds have been synthesized by one or more of the above methods:



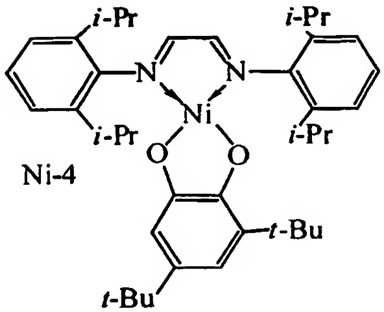
Ni-1



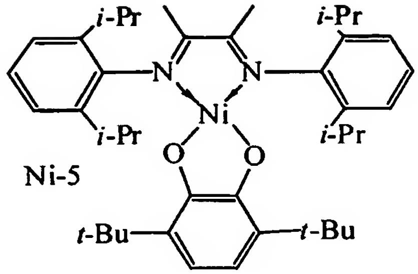
Ni-2



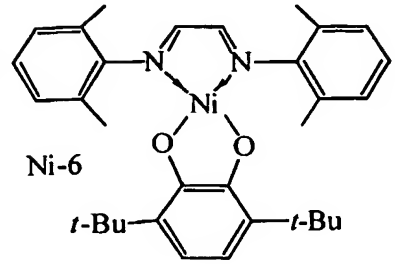
Ni-3



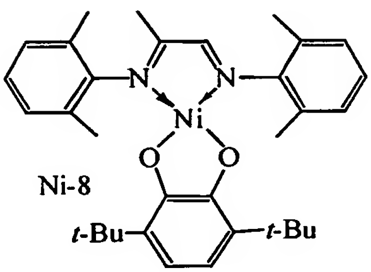
Ni-4



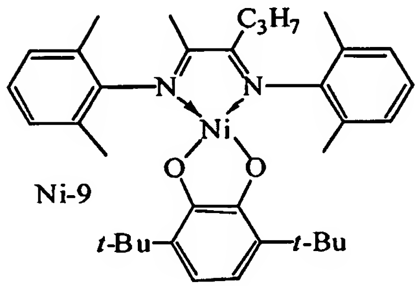
Ni-5



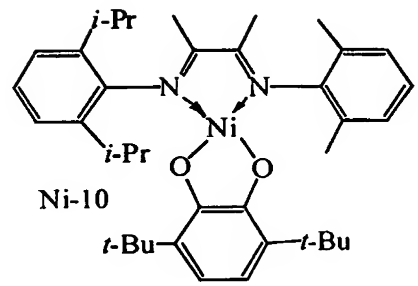
Ni-6



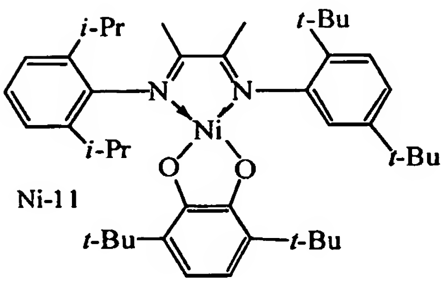
Ni-8



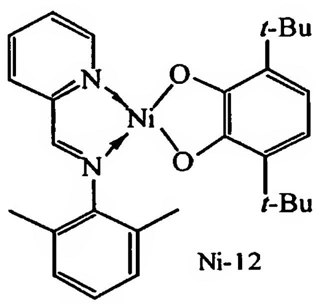
Ni-9



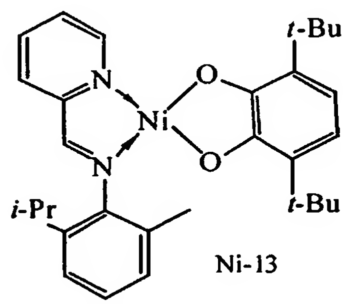
Ni-10



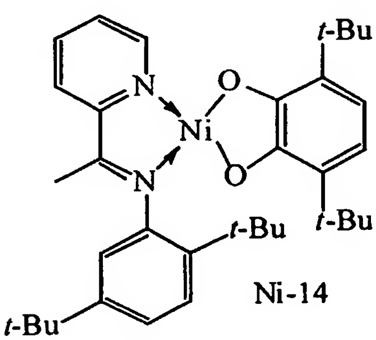
Ni-11



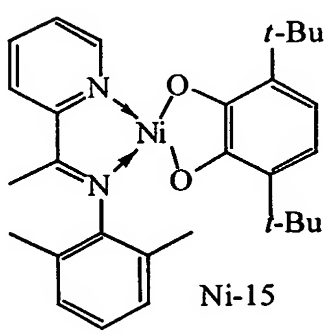
Ni-12



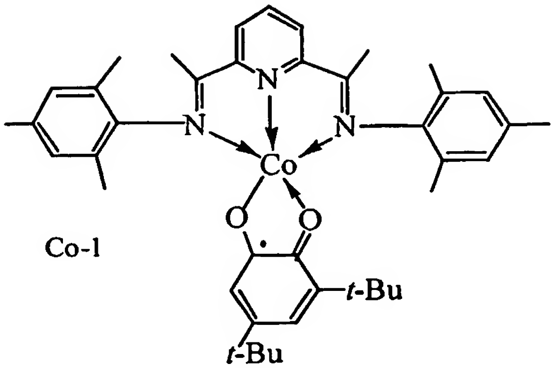
Ni-13



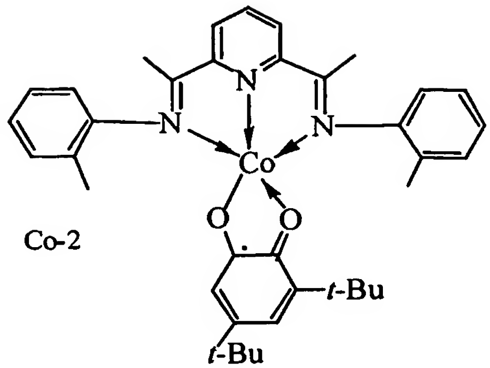
Ni-14



Ni-15



Co-1



Co-2

Mixed Catalysts

Mixed catalyst systems can also be used, for example, the invention catalyst can be used in conjunction with a second catalyst in the same reactor or in a series of reactors where the invention catalyst produces ethylene oligomers, macromers, or polymers with olefinic end-groups, and the second catalyst incorporates these oligomers, macromers, or polymers into a polymer backbone as a copolymer with other monomers, such as ethylene, propylene, butene, and other C2 to C20 olefins. Likewise, the invention catalyst can be used in conjunction with a second catalyst in the same reactor or in a series of reactors where the invention catalyst and the other catalyst produces mixtures or blends of polymers.

Invention polymerization catalyst systems can comprise additional olefin polymerization catalysts. These additional olefin polymerization catalysts are any of those well known in the art to catalyze the olefin to polyolefin reaction. Some invention catalysts systems include Group-4-6 metallocenes as additional olefin polymerization catalysts. Metallocenes include (un)bridged compounds containing one (mono(cyclopentadienyl) metallocenes) or two (bis(cyclopentadienyl) metallocenes) (un)substituted cyclopentadienyl ligand(s). In bridged metallocenes, a single, cyclopentadienyl ligand connects to a heteroatom ligand with both coordinating to the metal center, or two cyclopentadienyl ligands connect together with both cyclopentadienyl ligands coordinating to the metal center. Typical catalysts and their precursors are well known in the art. Suitable description appears in the patent literature, for example U. S. Patents 4,871,705, 4,937,299, 5,324,800, EP-A-0418044, EP-A-0591756, WO-A-92/00333 and WO-A-94/01471. Some embodiments select the metallocene compounds from mono- or bis-cyclopentadienyl-substituted, Group-4, -5,

and –6 metals in which cyclopentadienyls are (un)substituted with one or more groups or are bridged to each other or to a metal-coordinated heteroatom. Some embodiments select similar metallocene compounds except they are not necessarily bridged to each other or to a metal-coordinated heteroatom. See U.S. Patents 5,278,264 and 5,304,614.

Some invention catalysts systems include the following additional olefin polymerization catalysts. Metallocene compounds suitable for linear polyethylene or ethylene-containing copolymer production (where copolymer means comprising at least two different monomers) are essentially those disclosed in WO-A-92/00333, WO 97/44370 and U.S. Patents 5,001,205, 5,057,475, 5,198,401, 5,304,614, 5,308,816 and 5,324,800. Selection of metallocene compounds for isotactic or syndiotactic polypropylene blend production, and their syntheses, are well-known in the patent and academic literature, e.g. Journal of Organometallic Chemistry **369,** 359-370 (1989). Typically, those catalysts are stereorigid, asymmetric, chiral, or bridged-chiral metallocenes. Invention activators are suited for activating these types of catalyst precursors.

Likewise, some invention catalysts systems include the following additional olefin polymerization catalysts: monocyclopentadienyl metallocenes with Group-15 or –16 heteroatoms connected, through a bridging group, to a cyclopentadienyl-ligand ring carbon. Both the cyclopentadienyl Cp-ligand and the heteroatom connect to a transition metal. Some embodiments select a Group-4 transition metal. Additionally, unbridged monocyclopentadienyl, heteroatom-containing Group-4 components of WO 97/22639 will function with this invention. Moreover, transition metal systems with high-oxidation-state, Group-5-10 transition-metal centers are known and can serve as the additional olefin polymerization catalysts with invention catalyst systems.

Invention catalyst systems can use non-cyclopentadienyl, Group-4-5 precursor compounds as the additional olefin polymerization catalysts. Non-cyclopentadienyl, Group-4-5 precursor compounds are activable to stable, discrete cationic complexes include those containing bulky, chelating, diamide ligands, such as described in U. S. Patent 5,318,935 and "Conformationally Rigid Diamide Complexes: Synthesis and Structure of Tantalum (III) Alkyne Derivatives", D. H. McConville, et al, Organometallics **1995**, 14, 3154-3156. U.S. Patent 5,318,935 describes bridged and unbridged, bis-amido catalyst compounds of Group-4 metals capable of α-olefins polymerization. Bridged bis(arylamido) Group-4 compounds for olefin polymerization are described by D. H. McConville, et al., in

Organometallics 1995, 14, 5478-5480. Synthetic methods and compound characterization are presented. Further work appearing in D. H. McConville, et al, *Macromolecules* 1996, 29, 5241-5243, describes bridged bis(arylamido) Group-4 compounds that are polymerization catalysts for 1-hexene. Additional invention-suitable transition-metal compounds include those described in WO 96/40805. Cationic Group-3- or Lanthanide olefin polymerization complexes are disclosed in copending U.S. Application Ser. No. 09/408050, filed 29 September 1999, and its equivalent PCT/US99/22690. A monoanionic bidentate ligand and two monoanionic ligands stabilize those catalyst precursors; they are activable with this invention'' ionic cocatalysts. Other suitable Group-4-5 non-metallocene catalysts are bimetallocyclic catalyst compounds comprising two independently selected Group-4-5 metal atoms directly linked through two bridging groups to form cyclic compounds.

Invention catalyst systems can use other transition metal catalyst precursors that have a 2+ oxidation state as the additional olefin polymerization catalyst. Typical Ni^{2+} and Pd^{2+} complexes are diimines, see "New Pd(II)- and Ni(II)- Based Catalysts for Polymerization of Ethylene and α-Olefins", M. Brookhart, et al, J. Am. Chem. Soc., 1995, 117, 6414-6415, WO 96/23010 and WO 97/02298. See additionally the related bis(imino) Group-8 and –9 organometallic compounds described by V. C. Gibson and others in "Novel olefin polymerization catalysts based on iron and cobalt", Chem. Commun., 849-850, 1998.

For a review of other potential catalysts used in combination or series with the invention catalysts, see S. D. Ittel and L. K. Johnson, Chem. Rev. 2000, 1000, 1169 and V. C. Gibson and S. K. Spitzmesser, Chem. Rev. 2003, 103, 283.

Activators and Catalyst Activation

The catalyst precursors, when activated by a commonly known activator such as methyl alumoxane, form active catalysts for the polymerization or oligomerization of olefins. Activators that may be used include alumoxanes such as methyl alumoxane, modified methyl alumoxane, ethyl alumoxane, *iso*-butyl alumoxane and the like; Lewis acid activators preferably used in combination with a co-activator include triphenyl boron, tris-perfluorophenyl boron, tris-perfluorophenyl aluminum and the like; Ionic activators preferably used in combination with a co-activator include dimethylanilinium tetrakis perfluorophenyl borate, triphenyl carbonium tetrakis perfluorophenyl borate, dimethylanilinium tetrakis perfluorophenyl aluminate, and the like.

A co-activator is a compound capable of alkylating the transition metal complex, such that when used in combination with an activator, an active catalyst is formed. Co-activators include alumoxanes such as methyl alumoxane, modified alumoxanes such as modified methyl alumoxane, and trimethyl aluminum.

The alumoxane component useful as an activator typically is an oligomeric aluminum compound represented by the general formula $(R^x\text{-Al-O})_n$, which is a cyclic compound, or $R^x (R^x\text{-Al-O})_nAlR^x_2$, which is a linear compound. In the general alumoxane formula, R^x is independently a C_1-C_{20} alkyl radical, for example, methyl, ethyl, propyl, butyl, pentyl, isomers thereof, and the like, and "n" is an integer from 1-50. Most preferably, R^x is methyl and "n" is at least 4. Methyl alumoxane and modified methyl alumoxanes are most preferred. For further descriptions see, EP 0 279 586, EP 0 594 218, EP 0 561 476, WO94/10180 and US Pat. Nos. 4,665,208, 4,874,734, 4,908,463, 4,924,018, 4,952,540, 4,968,827, 5,041,584, 5,091,352, 5,103,031, 5,157,137, 5,204,419, 5,206,199, 5,235,081, 5,248,801, 5,329,032, 5,391,793, and 5,416,229.

When an alumoxane or modified alumoxane is used, the catalyst-precursor-to-activator molar ratio is from about 1:1000 to 10:1; alternatively, 1:500 to 1:1; alternatively 1:300 to 1:1; alternatively 1:200 to 1:1; alternatively 1:100 to 1:1; alternatively 1:50 to 1:1; alternatively 1:10 to 1:1. When the activator is an alumoxane (modified or unmodified), some embodiments select the maximum amount of activator at a 5000-fold molar excess over the catalyst precursor (per metal catalytic site). The preferred minimum activator-to-catalyst-precursor ratio is 1:1 molar ratio.

Ionic activators used in combination with a co-activator may be used in the practice of this invention. Preferably, discrete ionic activators such as $[Me_2PhNH][B(C_6F_5)_4]$, $[Ph_3C][B(C_6F_5)_4]$, $[Me_2PhNH][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[Ph_3C][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[Bu_3NH][BF_4]$, $[NH_4][PF_6]$, $[NH_4][SbF_6]$, $[NH_4][AsF_6]$, $[NH_4][B(C_6H_5)_4]$ or Lewis acidic activators such as $B(C_6F_5)_3$ or $B(C_6H_5)_3$ can be used. Preferred co-activators are alumoxanes such as methyl alumoxane, modified alumoxanes such as modified methyl alumoxane, and the trialkyl aluminum, trimethyl aluminum.

It is within the scope of this invention to use an ionizing or stoichiometric activator, neutral or ionic, such as tri (n-butyl) ammonium tetrakis (pentafluorophenyl) borate, a trisperfluorophenyl boron metalloid precursor or a trisperfluoronaphthyl boron metalloid

precursor, polyhalogenated heteroborane anions (WO 98/43983), boric acid (U.S. Patent No. 5,942,459) or combination thereof. When such activators are used, they are used in combination with a co-activator such as an alumoxane, modified alumoxane and/or trimethylaluminum.

Examples of neutral stoichiometric activators include tri-substituted boron, tellurium, aluminum, gallium and indium or mixtures thereof. The three substituent groups are each independently selected from alkyls, alkenyls, halogen, substituted alkyls, aryls, arylhalides, alkoxy and halides. Preferably, the three groups are independently selected from halogen, mono or multicyclic (including halosubstituted) aryls, alkyls, and alkenyl compounds and mixtures thereof, preferred are alkenyl groups having 1 to 20 carbon atoms, alkyl groups having 1 to 20 carbon atoms, alkoxy groups having 1 to 20 carbon atoms and aryl groups having 3 to 20 carbon atoms (including substituted aryls). More preferably, the three groups are alkyls having 1 to 4 carbon groups, phenyl, naphthyl or mixtures thereof. Even more preferably, the three groups are halogenated, preferably fluorinated, aryl groups. Most preferably, the neutral stoichiometric activator is trisperfluorophenyl boron or trisperfluoronaphthyl boron.

Ionic stoichiometric activator compounds may contain an active proton, or some other cation associated with, but not coordinated to, or only loosely coordinated to, the remaining ion of the ionizing compound. Such compounds and the like are described in European publications EP-A-0 570 982, EP-A-0 520 732, EP-A-0 495 375, EP-B1-0 500 944, EP-A-0 277 003 and EP-A-0 277 004, and U.S. Patent Nos. 5,153,157, 5,198,401, 5,066,741, 5,206,197, 5,241,025, 5,384,299 and 5,502,124 and U.S. Patent Application Serial No. 08/285,380, filed August 3, 1994, all of which are herein fully incorporated by reference.

Ionic catalysts can be prepared by reacting a transition metal compound with a co-activator that alkylates the transition metal compound, and some neutral Lewis acids, such as $B(C_6F_6)_3$, which upon reaction with the hydrolyzable ligand (X') of the alkylated transition metal compound forms an anion, such as $([B(C_6F_5)_3(X')]^-)$, which stabilizes the cationic transition metal species generated by the reaction. The catalysts can be, and preferably are, prepared with activator components which are ionic compounds or compositions. However preparation of activators utilizing neutral compounds is also contemplated by this invention.

Compounds useful as an activator component in the preparation of the ionic catalyst systems used in the process of this invention comprise a cation, which is preferably a Bronsted acid capable of donating a proton, and a compatible non-coordinating anion which

anion is relatively large (bulky), capable of stabilizing the active catalyst species which is formed when the two compounds are combined and said anion will be sufficiently labile to be displaced by olefinic diolefinic and acetylenically unsaturated substrates or other neutral Lewis bases such as ethers, nitriles and the like. Two classes of compatible non-coordinating anions have been disclosed in EPA 277,003 and EPA 277,004 published 1988: 1) anionic coordination complexes comprising a plurality of lipophilic radicals covalently coordinated to and shielding a central charge-bearing metal or metalloid core, and 2) anions comprising a plurality of boron atoms such as carboranes, metallacarboranes and boranes.

In a preferred embodiment, the stoichiometric activators include a cation and an anion component, and may be represented by the following formula:

$(L^{**}\text{-}H)_d^+ (A^{d-})$

wherein L** is an neutral Lewis base;

H is hydrogen;

$(L^{**}\text{-}H)^+$ is a Bronsted acid

A^{d-} is a non-coordinating anion having the charge d-

d is an integer from 1 to 3.

The cation component, $(L^{**}\text{-}H)_d^+$ may include Bronsted acids such as protons or protonated Lewis bases or reducible Lewis acids capable of protonating or abstracting a moiety, such as an alkyl or aryl, from the precatalyst after alkylation.

The activating cation $(L^{**}\text{-}H)_d^+$ may be a Bronsted acid, capable of donating a proton to the alkylated transition metal catalytic precursor resulting in a transition metal cation, including ammoniums, oxoniums, phosphoniums, silyliums, and mixtures thereof, preferably ammoniums of methylamine, aniline, dimethylamine, diethylamine, N-methylaniline, diphenylamine, trimethylamine, triethylamine, N,N-dimethylaniline, methyldiphenylamine, pyridine, p-bromo N,N-dimethylaniline, p-nitro-N,N-dimethylaniline, phosphoniums from triethylphosphine, triphenylphosphine, and diphenylphosphine, oxomiuns from ethers such as dimethyl ether, diethyl ether, tetrahydrofuran and dioxane, sulfoniums from thioethers, such as diethyl thioethers and tetrahydrothiophene, and mixtures thereof. The activating cation $(L^{**}\text{-}H)_d^+$ may also be a moiety such as silver, tropylium, carbeniums, ferroceniums and mixtures, preferably carboniums and ferroceniums; most preferably triphenyl carbonium.

The anion component A^{d-} include those having the formula $[M^{k+}Q_n]^{d-}$ wherein k is an integer from 1 to 3; n is an integer from 2-6; n - k = d; M is an element selected from Group

13 of the Periodic Table of the Elements, preferably boron or aluminum, and Q is independently a hydride, bridged or unbridged dialkylamido, halide, alkoxide, aryloxide, hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, and halosubstituted-hydrocarbyl radicals, said Q having up to 20 carbon atoms with the proviso that in not more than one occurrence is Q a halide. Preferably, each Q is a fluorinated hydrocarbyl group having 1 to 20 carbon atoms, more preferably each Q is a fluorinated aryl group, and most preferably each Q is a pentafluoryl aryl group. Examples of suitable A^{d-} also include diboron compounds as disclosed in U.S. Pat. No. 5,447,895, which is fully incorporated herein by reference.

Illustrative, but not limiting examples of boron compounds which may be used as an activating cocatalyst in combination with a co-activator in the preparation of the improved catalysts of this invention are tri-substituted ammonium salts such as: trimethylammonium tetraphenylborate, triethylammonium tetraphenylborate, tripropylammonium tetraphenylborate, tri(*n*-butyl)ammonium tetraphenylborate, tri(*tert*-butyl)ammonium tetraphenylborate, N,N-dimethylanilinium tetraphenylborate, N,N-diethylanilinium tetraphenylborate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetraphenylborate, trimethylammonium tetrakis(pentafluorophenyl)borate, triethylammonium tetrakis(pentafluorophenyl)borate, tripropylammonium tetrakis(pentafluorophenyl)borate, tri(*n*-butyl)ammonium tetrakis(pentafluorophenyl)borate, tri(*sec*-butyl)ammonium tetrakis(pentafluorophenyl)borate, N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate, N,N-diethylanilinium tetrakis(pentafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(pentafluorophenyl)borate, trimethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl) borate, triethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tripropylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tri(*n*-butyl)ammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, dimethyl(*tert*-butyl)ammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-diethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis-(2,3,4,6-tetrafluorophenyl)borate, trimethylammonium tetrakis(perfluoronaphthyl)borate, triethylammonium tetrakis(perfluoronaphthyl)borate, tripropylammonium tetrakis(perfluoronaphthyl)borate, tri(*n*-butyl)ammonium tetrakis(perfluoronaphthyl)borate, tri(*tert*-butyl)ammonium tetrakis(perfluoronaphthyl)borate, N,N-dimethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-diethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium)

tetrakis(perfluoronaphthyl)borate, trimethylammonium tetrakis(perfluorobiphenyl)borate, triethylammonium tetrakis(perfluorobiphenyl)borate, tripropylammonium tetrakis(perfluorobiphenyl)borate, tri(*n*-butyl)ammonium tetrakis(perfluorobiphenyl)borate, tri(*tert*-butyl)ammonium tetrakis(perfluorobiphenyl)borate, N,N-dimethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-diethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(perfluorobiphenyl)borate, trimethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tripropylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(*n*-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(*tert*-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-diethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, and dialkyl ammonium salts such as: di-(*iso*-propyl)ammonium tetrakis(pentafluorophenyl)borate, and dicyclohexylammonium tetrakis(pentafluorophenyl)borate; and other salts such as tri(o-tolyl)phosphonium tetrakis(pentafluorophenyl)borate, tri(2,6-dimethylphenyl)phosphonium tetrakis(pentafluorophenyl)borate, tropillium tetraphenylborate, triphenylcarbenium tetraphenylborate, triphenylphosphonium tetraphenylborate, triethylsilylium tetraphenylborate, benzene(diazonium)tetraphenylborate, tropillium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(pentafluorophenyl)borate, triphenylphosphonium tetrakis(pentafluorophenyl)borate, triethylsilylium tetrakis(pentafluorophenyl)borate, benzene(diazonium) tetrakis(pentafluorophenyl)borate, tropillium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylcarbenium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylphosphonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triethylsilylium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, benzene(diazonium) tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tropillium tetrakis(perfluoronaphthyl)borate, triphenylcarbenium tetrakis(perfluoronaphthyl)borate, triphenylphosphonium tetrakis(perfluoronaphthyl)borate, triethylsilylium tetrakis(perfluoronaphthyl)borate, benzene(diazonium) tetrakis(perfluoronaphthyl)borate, tropillium tetrakis(perfluorobiphenyl)borate, triphenylcarbenium tetrakis(perfluorobiphenyl)borate, triphenylphosphonium tetrakis(perfluorobiphenyl)borate, triethylsilylium tetrakis(perfluorobiphenyl)borate, benzene(diazonium) tetrakis(perfluorobiphenyl)borate,

tropillium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylphosphonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylsilylium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, and benzene(diazonium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate.

Most preferably, the ionic stoichiometric activator $(L^{**}\text{-}H)_d^+ (A^{d-})$ is N,N-dimethylanilinium tetrakis(perfluorophenyl)borate, N,N-dimethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-dimethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-dimethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium tetrakis(perfluoronaphthyl)borate, triphenylcarbenium tetrakis(perfluorobiphenyl)borate, triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, or triphenylcarbenium tetra(perfluorophenyl)borate.

Invention catalyst precursors can also be activated with cocatalysts or activators that comprise non-coordinating anions containing metalloid-free cyclopentadienide ions. These are described in U.S. Patent Publication 2002/0058765 A1, published on 16 May 2002, and for the instant invention, require the addition of a co-activator to the catalyst pre-cursor.

The term "non-coordinating anion" (NCA) means an anion that does not coordinate to the catalyst metal cation or that does coordinate to the metal cation, but only weakly. An NCA coordinates weakly enough that a neutral Lewis base, such as an olefinically or acetylenically unsaturated monomer can displace it from the catalyst center. "Compatible" non-coordinating anions are those which are not degraded to neutrality when the initially formed complex decomposes. Further, the anion will not transfer an anionic substituent or fragment to the cation so as to cause it to form a neutral transition metal compound and a neutral by-product from the anion. Non-coordinating anions useful in accordance with this invention are those that are compatible, stabilize the transition metal complex cation in the sense of balancing its ionic charge at +1, yet retain sufficient lability to permit displacement by an ethylenically or acetylenically unsaturated monomer during polymerization. These types of cocatalysts sometimes use scavengers such as but not limited to tri-*iso*-butyl aluminum, tri-*n*-octyl aluminum, tri-*n*-hexyl aluminum, triethylaluminum or trimethylaluminum.

Invention process also can employ cocatalyst compounds or activator compounds that are initially neutral Lewis acids but form a cationic metal complex and a noncoordinating

anion, or a zwitterionic complex upon reaction with the alkylated transition metal compounds. The alkylated invention compound is formed from the reaction of the catalyst pre-cursor and the co-activator. For example, tris(pentafluorophenyl) boron or aluminum act to abstract a hydrocarbyl ligand to yield an invention cationic transition metal complex and stabilizing noncoordinating anion, see EP-A-0 427 697 and EP-A-0 520 732 for illustrations of analogous Group-4 metallocene compounds. Also, see the methods and compounds of EP-A-0 495 375. For formation of zwitterionic complexes using analogous Group 4 compounds, see U.S. Patents 5,624,878; 5,486,632; and 5,527,929.

Additional neutral Lewis-acids are known in the art and are suitable for abstracting formal anionic ligands. See in particular the review article by E. Y.-X. Chen and T.J. Marks, "Cocatalysts for Metal-Catalyzed Olefin Polymerization: Activators, Activation Processes, and Structure-Activity Relationships", *Chem. Rev.*, *100*, 1391-1434 (2000).

When the cations of noncoordinating anion precursors are Bronsted acids such as protons or protonated Lewis bases (excluding water), or reducible Lewis acids such as ferrocenium or silver cations, or alkali or alkaline earth metal cations such as those of sodium, magnesium or lithium, the catalyst-precursor-to-activator molar ratio may be any ratio. Combinations of the described activator compounds may also be used for activation.

When an ionic or neutral stoichiometric activator is used, the catalyst-precursor-to-activator molar ratio is from 1:10 to 1:1; 1:10 to 10:1; 1:10 to 2:1; 1:10 to 3:1; 1:10 to 5:1; 1:2 to 1.2:1; 1:2 to 10:1; 1:2 to 2:1; 1:2 to 3:1; 1:2 to 5:1; 1:3 to 1.2:1; 1:3 to 10:1; 1:3 to 2:1; 1:3 to 3:1; 1:3 to 5:1; 1:5 to 1:1; 1:5 to 10:1; 1:5 to 2:1; 1:5 to 3:1; 1:5 to 5:1; 1:1 to 1:1.2. The catalyst-precursor-to-co-activator molar ratio is from 1:100 to 100:1; 1:75 to 75:1; 1:50 to 50:1; 1:25 to 25:1; 1:15 to 15:1; 1:10 to 10:1; 1:5 to 5:1, 1:2 to 2:1; 1:100 to 1:1; 1:75 to 1:1; 1:50 to 1:1; 1:25 to 1:1; 1:15 to 1:1; 1:10 to 1:1; 1:5 to 1:1; 1:2 to 1:1; 1:10 to 2:1.

Preferred activators and activator/co-activator combinations include methylalumoxane, modified methylalumoxane, mixtures of methylalumoxane with dimethylanilinium tetrakis(pentafluorophenyl)borate or tris(pentafluorophenyl)boron, and mixtures of trimethyl aluminum with dimethylanilinium tetrakis(pentafluorophenyl)borate or tris(pentafluorophenyl)boron

In some embodiments, scavenging compounds are used with stoichiometric activators. Typical aluminum or boron alkyl components useful as scavengers are

represented by the general formula R^xJZ_2 where J is aluminum or boron, R^x is as previously defined above, and each Z is independently R^x or a different univalent anionic ligand such as halogen (Cl, Br, I), alkoxide (OR^x) and the like. Most preferred aluminum alkyls include triethylaluminum, diethylaluminum chloride, tri-*iso*-butylaluminum, tri-*n*-octylaluminum. tri-*n*-hexylaluminum, trimethylaluminum and the like. Preferred boron alkyls include triethylboron. Scavenging compounds may also be alumoxanes and modified alumoxanes including methylalumoxane and modified methylalumoxane.

Additionally, the active catalyst component can be formed *in situ* by mixing together the bidentate or tridentate chelating ligand, the metal carbonyl, and the 1,2-benzoquinone. This mixture is then added to the reactor and an activator is added, preferably in the presence of olefin. Other neutral metals or metal complexes may be used in place of the metal carbonyl, for example, in place of nickel carbonyl ($Ni(CO)_4$), bis(1,5-cyclooctadiene) nickel(0), bis(triphenylphosphine)nickel dicarbonyl, tetrakis(trifluorophosphine) nickel(0), nickel powder and the like; in place of cobalt carbonyl ($Co_2(CO)_8$), cobalt tricarbonyl nitrosyl, cobalt powder and the like; in place of iron carbonyl ($Fe(CO)_5$, $Fe_3(CO)_{12}$ or $Fe_2(CO)_9$), cyclohexadiene iron tricarbonyl, cyclooctatetrene iron tricarbonyl, or iron powder.

Supported Catalysts

The solubility of invention catalyst precursors allows for the ready preparation of supported catalysts. To prepare uniform supported catalysts, the catalyst precursor preferably dissolves in the chosen solvent. The term "uniform supported catalyst" means that the catalyst precursor, the activator and or the activated catalyst approach uniform distribution upon the support's accessible surface area, including the interior pore surfaces of porous supports. Some embodiments of supported catalysts prefer uniform supported catalysts; other embodiments show no such preference.

Invention supported catalyst systems may be prepared by any method effective to support other coordination catalyst systems, effective meaning that the catalyst so prepared can be used for oligomerizing or polymerizing olefin in a heterogenous process. The catalyst precursor, activator, co-activator if needed, suitable solvent, and support may be added in any order or simultaneously.

By one method, the activator, dissolved in an appropriate solvent such as toluene may be stirred with the support material for 1 minute to 10 hours. The total solution volume may be greater than the pore volume of the support, but some embodiments limit the total solution volume below that needed to form a gel or slurry (about 90% to 400 %, preferably about 100-200% of the pore volume). The mixture is optionally heated from 30-200 °C during this time. The catalyst precursor may be added to this mixture as a solid, if a suitable solvent is employed in the previous step, or as a solution. Or alternatively, this mixture can be filtered, and the resulting solid mixed with a catalyst precursor solution. Similarly, the mixture may be vacuum dried and mixed with a catalyst precursor solution. The resulting catalyst mixture is then stirred for 1 minute to 10 hours, and the catalyst is either filtered from the solution and vacuum dried or evaporation alone removes the solvent.

Alternatively, the catalyst precursor and activator may be combined in solvent to form a solution. Then the support is added, and the mixture is stirred for 1 minute to 10 hours. The total solution volume may be greater than the pore volume of the support, but some embodiments limit the total solution volume below that needed to form a gel or slurry (about 90% to 400 %, preferably about 100-200% of the pore volume). After stirring, the residual solvent is removed under vacuum, typically at ambient temperature and over 10-16 hours. But greater or lesser times and temperatures are possible.

The catalyst precursor may also be supported absent the activator; in that case, the activator (and co-activator if needed) is added to a slurry process's liquid phase. For example, a solution of catalyst precursor may be mixed with a support material for a period of about 1 minute to 10 hours. The resulting precatalyst mixture may be filtered from the solution and dried under vacuum, or evaporation alone removes the solvent. The total, catalyst-precursor-solution volume may be greater than the support's pore volume, but some embodiments limit the total solution volume below that needed to form a gel or slurry (about 90% to 400 %, preferably about 100-200% of the pore volume).

Additionally, two or more different catalyst precursors may be placed on the same support using any of the support methods disclosed above. Likewise, two or more activators or an activator and co-activator may be placed on the same support.

Suitable solid particle supports are typically comprised of polymeric or refractory oxide materials, each being preferably porous. Any support material that has an average particle size greater than 10 μm is suitable for use in this invention. Various embodiments select a porous support material, such as for example, talc, inorganic oxides, inorganic chlorides, for example magnesium chloride and resinous support materials such as polystyrene polyolefin or polymeric compounds or any other organic support material and the like. Some embodiments select inorganic oxide materials as the support material including Group-2, -3, -4, -5, -13, or -14 metal or metalloid oxides. Some embodiments select the catalyst support materials to include silica, alumina, silica-alumina, and their mixtures. Other inorganic oxides may serve either alone or in combination with the silica, alumina, or silica-alumina. These are magnesia, titania, zirconia, and the like. Lewis acidic materials such as montmorillonite and similar clays may also serve as a support. In this case, the support can optionally double as the activator component. But additional activator may also be used.

The support material may be pretreated by any number of methods. For example, inorganic oxides may be calcined, chemically treated with dehydroxylating agents such as aluminum alkyls and the like, or both.

As stated above, polymeric carriers will also be suitable in accordance with the invention, see for example the descriptions in WO 95/15815 and U.S. patent 5,427,991. The methods disclosed may be used with the catalyst complexes, activators or catalyst systems of this invention to adsorb or absorb them on the polymeric supports, particularly if made up of porous particles, or may be chemically bound through functional groups bound to or in the polymer chains.

Invention catalyst carriers may have a surface area of from 10-700 m^2/g, a pore volume of 0.1-4.0 cc/g and an average particle size of 10-500 μm. Some embodiments select a surface area of 50-500 m^2/g, a pore volume of 0.5-3.5 cc/g, or an average particle size of 20-200 μm. Other embodiments select a surface area of 100-400 m^2/g, a pore volume of 0.8-3.0 cc/g, and an average particle size of 30-100 μm. Invention carriers typically have a pore size of 10-1000 Angstroms, alternatively 50-500 Angstroms, or 75-350 Angstroms.

Invention catalysts are generally deposited on the support at a loading level of 10-100 micromoles of catalyst precursor per gram of solid support; alternately 20-80 micromoles

of catalyst precursor per gram of solid support; or 40-60 micromoles of catalyst precursor per gram of support. But greater or lesser values may be used provided that the total amount of solid catalyst precursor does not exceed the support's pore volume.

Invention catalysts can be supported for gas-phase, bulk, or slurry polymerization, or otherwise as needed. Numerous support methods are known for catalysts in the olefin polymerization art, particularly alumoxane-activated catalysts; all are suitable for this invention's broadest practice. See, for example, U.S. Patents 5,057,475 and 5,227,440. An example of supported ionic catalysts appears in WO 94/03056. U.S. Patent 5,643,847 and WO 96/04319A describe a particularly effective method. A bulk or slurry process using this invention's supported metal complexes activated with alumoxane can be used for ethylene-propylene rubber as described in U.S. Patents 5,001,205 and 5,229,478. Additionally, those processes suit this invention's catalyst systems. Both polymers and inorganic oxides may serve as supports, as is known in the art. See U.S. Patents 5,422,325, 5,427,991, 5,498,582 and 5,466,649, and international publications WO 93/11172 and WO 94/07928.

Additionally, oxidizing agents may be added to the supported or unsupported catalyst as described in WO 01/68725.

Monomers

In a preferred embodiment the catalyst compounds of this invention are used to polymerize or oligomerize any unsaturated monomer or monomers. Preferred monomers include C_2 to C_{100} olefins, preferably C_2 to C_{60} olefins, preferably C_2 to C_{40} olefins preferably C_2 to C_{20} olefins, preferably C_2 to C_{12} olefins. In some embodiments preferred monomers include linear, branched or cyclic alpha-olefins, preferably C_2 to C_{100} alpha-olefins, preferably C_2 to C_{60} alpha-olefins, preferably C_2 to C_{40} alpha-olefins preferably C_2 to C_{20} alpha-olefins, preferably C_2 to C_{12} alpha-olefins. Preferred olefin monomers may be one or more of ethylene, propylene, butene, pentene, hexene, heptene, octene, nonene, decene, dodecene, 4-methylpentene-1, 3-methylpentene-1, 3,5,5-trimethylhexene-1, and 5-ethylnonene-1.

In another embodiment the polymer produced herein is a copolymer of one or more linear or branched C_3 to C_{30} prochiral alpha-olefins or C_5 to C_{30} ring containing olefins or combinations thereof capable of being polymerized by either stereospecific and non-stereospecific catalysts. Prochiral, as used herein, refers to monomers that favor the

formation of isotactic or syndiotactic polymer when polymerized using stereospecific catalyst(s).

Preferred monomers may also include aromatic-group-containing monomers containing up to 30 carbon atoms. Suitable aromatic-group-containing monomers comprise at least one aromatic structure, preferably from one to three, more preferably a phenyl, indenyl, fluorenyl, or naphthyl moiety. The aromatic-group-containing monomer further comprises at least one polymerizable double bond such that after polymerization, the aromatic structure will be pendant from the polymer backbone. The aromatic-group containing monomer may further be substituted with one or more hydrocarbyl groups including but not limited to C_1 to C_{10} alkyl groups. Additionally two adjacent substitutions may be joined to form a ring structure. Preferred aromatic-group-containing monomers contain at least one aromatic structure appended to a polymerizable olefinic moiety. Particularly preferred aromatic monomers include styrene, alpha-methylstyrene, para-alkylstyrenes, vinyltoluenes, vinylnaphthalene, allyl benzene, and indene, especially styrene, para-methylstyrene, 4-phenyl-1-butene and allyl benzene.

Non aromatic cyclic group containing monomers are also preferred. These monomers can contain up to 30 carbon atoms. Suitable non-aromatic cyclic group containing monomers preferably have at least one polymerizable olefinic group that is either pendant on the cyclic structure or is part of the cyclic structure. The cyclic structure may also be further substituted by one or more hydrocarbyl groups such as, but not limited to, C_1 to C_{10} alkyl groups. Preferred non-aromatic cyclic group containing monomers include vinylcyclohexane, vinylcyclohexene, cyclopentadiene, cyclopentene, 4-methylcyclopentene, cyclohexene, 4-methylcyclohexene, cyclobutene, vinyladamantane, norbornene, 5-methylnorbornene, 5-ethylnorbornene, 5-propylnorbornene, 5-butylylnorbornene, 5-pentylnorbornene, 5-hexylnorbornene, 5-heptylnorbornene, 5-octylnorbornene, 5-nonylnorbornene, 5-decylnorbornene, 5-phenylnorbornene, vinylnorbornene, ethylidene norbornene, 5,6-dimethylnorbornene, 5,6-dibutylnorbornene and the like.

Preferred diolefin monomers useful in this invention include any hydrocarbon structure, preferably C_4 to C_{30}, having at least two unsaturated bonds, wherein at least one, typically two, of the unsaturated bonds are readily incorporated into a polymer by either a stereospecific or a non-stereospecific catalyst(s). It is further preferred that the diolefin monomers be selected from alpha-omega-diene monomers (i.e. di-vinyl monomers). More preferably, the diolefin monomers are linear di-vinyl monomers, most preferably those

containing from 4 to 30 carbon atoms. Examples of preferred dienes include butadiene, pentadiene, hexadiene, heptadiene, octadiene, nonadiene, decadiene, undecadiene, dodecadiene, tridecadiene, tetradecadiene, pentadecadiene, hexadecadiene, heptadecadiene, octadecadiene, nonadecadiene, icosadiene, heneicosadiene, docosadiene, tricosadiene, tetracosadiene, pentacosadiene, hexacosadiene, heptacosadiene, octacosadiene, nonacosadiene, triacontadiene, particularly preferred dienes include 1,6-heptadiene, 1,7-octadiene, 1,8-nonadiene, 1,9-decadiene, 1,10-undecadiene, 1,11-dodecadiene, 1,12-tridecadiene, 1,13-tetradecadiene, and low molecular weight polybutadienes (Mw less than 1000 g/mol). Preferred cyclic dienes include cyclopentadiene, vinylnorbornene, norbornadiene, ethylidene norbornene, divinylbenzene, dicyclopentadiene or higher ring containing diolefins with or without substituents at various ring positions.

Non-limiting examples of preferred polar unsaturated monomers useful in this invention include nitro substituted monomers including 6-nitro-1-hexene; amine substituted monomers including N-methylallylamine, N-allylcyclopentylamine, and N-allyl-hexylamine; ketone substituted monomers including methyl vinyl ketone, ethyl vinyl ketone, and 5-hexen-2-one; aldehyde substituted monomers including acrolein, 2,2-dimethyl-4-pentenal, undecylenic aldehyde, and 2,4-dimethyl-2,6-heptadienal; alcohol substituted monomers including allyl alcohol, 7-octen-1-ol, 7-octene-1,2-diol, 10-undecen-1-ol, 10-undecene-1,2-diol, 2-methyl-3-buten-1-ol; acetal, epoxide and or ether substituted monomers including 4-hex-5-enyl-2,2-dimethyl-[1,3]dioxolane, 2,2- dimethyl-4-non-8-enyl-[1,3]dioxolane, acrolein dimethyl acetal, butadiene monoxide, 1,2-epoxy-7-octene, 1,2-epoxy-9-decene, 1,2-epoxy-5-hexene, 2-methyl-2-vinyloxirane, allyl glycidyl ether, 2,5-dihydrofuran, 2-cyclopenten-1-one ethylene ketal, 11-methoxyundec-1-ene, and 8-methoxyoct-1-ene; sulfur containing monomers including allyl disulfide; acid and ester substituted monomers including acrylic acid, vinylacetic acid, 4-pentenoic acid, 2,2-dimethyl-4-pentenoic acid, 6-heptenoic acid, trans-2,4-pentadienoic acid, 2,6-heptadienoic acid, methyl acrylate, ethyl acrylate, *tert*-butyl acrylate, *n*-butyl acrylate, methacrylic acid, methyl methacrylate, ethyl methacrylate, *tert*-butyl methacrylate, *n*-butyl methacrylate, hydroxypropyl acrylate, acetic acid oct-7-enyl ester, non-8-enoic acid methyl ester, acetic acid undec-10-enyl ester, dodec-11-enoic acid methyl ester, propionic acid undec-10-enyl ester, dodec-11-enoic acid ethyl ester, and nonylphenoxypolyetheroxy acrylate; siloxy containing monomers including trimethyloct-7-enyloxy silane, and trimethylundec-10-enyloxy silane, polar functionalized norbornene monomers including 5-norbornene-2-carbonitrile, 5-norbornene-2-carboxaldehyde, 5-

norbornene-2-carboxylic acid, cis-5-norbornene-endo-2,3-dicarboxylic acid, 5-norbornene-2,2,-dimethanol, cis-5-norbornene-endo-2,3-dicarboxylic anhydride, 5-norbornene-2-endo-3-endo-dimethanol, 5-norbornene-2-endo-3-exo-dimethanol, 5-norbornene-2-methanol, 5-norbornene-2-ol, 5-norbornene-2-yl acetate, 1-[2-(5-norbornene-2-yl)ethyl]-3,5,7,9,11,13,15-heptacyclopentylpentacyclo[9.5.1.1^{3,9}.1^{5,15}.1^{7,13}]octasiloxane, 2-benzoyl-5-norbornene, 2-acetyl-5-norbornene, 7-syn methoxymethyl-5-norbornen-2-one, 5-norbornen-2-ol, and 5-norbornen-2-yloxy-trimethylsilane, and partially fluorinated monomers including nonafluoro-1-hexene, allyl-1,1,2,2,-tetrafluoroethyl ether, 2,2,3,3-tetrafluoro-non-8-enoic acid ethyl ester, 1,1,2,2-tetrafluoro-2-(1,1,2,2-tetrafluoro-oct-7-enyloxy)-ethanesulfonyl fluoride, acrylic acid 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-octyl ester, and 1,1,2,2-tetrafluoro-2-(1,1,2,2,3,3,4,4-octafluoro-dec-9-enyloxy)-ethanesulfonyl fluoride.

In an embodiment herein, the process described herein is used to produce an oligomer of any of the monomers listed above. Preferred oligomers include oligomers of any C_2 to C_{20} olefins, preferably C_2 to C_{12} alpha-olefins, most preferably oligomers comprising ethylene, propylene and or butene are prepared. A preferred feedstock for the oligomerization process is the alpha-olefin, ethylene. But other alpha-olefins, including but not limited to propylene and 1-butene, may also be used alone or combined with ethylene. Preferred alpha-olefins include any C_2 to C_{40} alpha-olefin, preferably and C_2 to C_{20} alpha-olefin, preferably any C_2 to C_{12} alpha-olefin, preferably ethylene, propylene, and butene, most preferably ethylene. Dienes may be used in the processes described herein, preferably alpha-omega-dienes are used alone or in combination with mono-alpha olefins.

In a preferred embodiment the process described herein may be used to produce homopolymers or copolymers. (For the purposes of this invention and the claims thereto a copolymer may comprise two, three, four or more different monomer units.) Preferred polymers produced herein include homopolymers or copolymers of any of the above monomers. In a preferred embodiment the polymer is a homopolymer of any C_2 to C_{12} alpha-olefin. Preferably the polymer is a homopolymer of ethylene or a homopolymer of propylene. In another embodiment the polymer is a copolymer comprising ethylene and one or more of any of the monomers listed above. In another embodiment the polymer is a copolymer comprising propylene and one or more of any of the monomers listed above. In another preferred embodiment the homopolymers or copolymers described, additionally comprise one or more diolefin comonomers, preferably one or more C_4 to C_{40} diolefins.

In another preferred embodiment the polymer produced herein is a copolymer of ethylene and one or more C_3 to C_{20} linear, branched or cyclic monomers, preferably one or more C_3 to C_{12} linear, branched or cyclic alpha-olefins. Preferably the polymer produced herein is a copolymer of ethylene and one or more of propylene, butene, pentene, hexene, heptene, octene, nonene, decene, dodecene, 4-methylpentene-1, 3-methylpentene-1, 3,5,5-trimethylhexene-1, cyclopentene, 4-methylcyclopentene, cyclohexene, and 4-methylcyclohexene.

In another preferred embodiment the polymer produced herein is a copolymer of propylene and one or more C_2 or C_4 to C_{20} linear, branched or cyclic monomers, preferably one or more C_2 or C_4 to C_{12} linear, branched or cyclic alpha-olefins. Preferably the polymer produced herein is a copolymer of propylene and one or more of ethylene, butene, pentene, hexene, heptene, octene, nonene, decene, dodecene, 4-methylpentene-1, 3-methylpentene-1, and 3,5,5-trimethylhexene-1.

In a preferred embodiment, the polymer produced herein is a homopolymer of norbornene or a copolymer of norbornene and a substituted norbornene, including polar functionalized norbornenes.

In a preferred embodiment the copolymers described herein comprise at least 50 mole% of a first monomer and up to 50 mole% of other monomers.

In another embodiment, the polymer comprises:

a first monomer present at from 40 to 95 mole%, preferably 50 to 90 mole%, preferably 60 to 80 mole %, and

a comonomer present at from 5 to 60 mole%, preferably 10 to 40 mole%, more preferably 20 to 40 mole%, and

a termonomer present at from 0 to 10 mole%, more preferably from 0.5 to 5 mole%, more preferably 1 to 3 mole%.

In a preferred embodiment the first monomer comprises one or more of any C_3 to C_8 linear branched or cyclic alpha-olefins, including propylene, butene, (and all isomers thereof), pentene (and all isomers thereof), hexene (and all isomers thereof), heptene (and all isomers thereof), and octene (and all isomers thereof). Preferred monomers include propylene, 1-butene, 1-hexene, 1-octene, cyclopentene, cyclohexene, cyclooctene, hexadiene, cyclohexadiene and the like.

In a preferred embodiment the comonomer comprises one or more of any C_2 to C_{40} linear, branched or cyclic alpha-olefins (provided ethylene, if present, is present at 5 mole%

or less), including ethylene, propylene, butene, pentene, hexene, heptene, and octene, nonene, decene, undecene, dodecene, hexadecene, butadiene, hexadiene, heptadiene, pentadiene, octadiene, nonadiene, decadiene, dodecadiene, styrene, 3,5,5-trimethylhexene-1, 3-methylpentene-1, 4-methylpentene-1, cyclopentadiene, and cyclohexene.

In a preferred embodiment the termonomer comprises one or more of any C_2 to C_{40} linear, branched or cyclic alpha-olefins, (provided ethylene, if present, is present at 5 mole% or less), including ethylene, propylene, butene, pentene, hexene, heptene, and octene, nonene, decene, undecene, dodecene, hexadecene, butadiene, hexadiene, heptadiene, pentadiene, octadiene, nonadiene, decadiene, dodecadiene, styrene, 3,5,5-trimethylhexene-1, 3-methylpentene-1, 4-methylpentene-1, cyclopentadiene, and cyclohexene.

In a preferred embodiment the polymers described above further comprise one or more dienes at up to 10 weight%, preferably at 0.00001 to 1.0 weight%, preferably 0.002 to 0.5 weight%, even more preferably 0.003 to 0.2 weight%, based upon the total weight of the composition. In some embodiments 500 ppm or less of diene is added to the polymerization, preferably 400 ppm or less, preferably or 300 ppm or less. In other embodiments at least 50 ppm of diene is added to the polymerization, or 100 ppm or more, or 150 ppm or more.

Oligomerization Processes

The catalyst compositions described above may be used to oligomerize or polymerize any unsaturated monomer. The choice between oligomerization and polymerization is dependent on the exact structure of the transition metal precatalyst. Those with bulkier ligands about the catalyst site, tend to produce polymers, whereas those that are less bulky about the catalyst active site, tend to produce oligomers.

In the instant oligomerization processes, the process temperature may be -100°C to 300°C, -20°C to 200°C, or 0°C to 150°C. Some embodiments select oligomerization pressures (gauge) from 0 kPa-35 MPa or 500 kPa-15 MPa. In a preferred embodiment, conditions that favor oligomer production include using aluminum alkyls (as activator or scavenger, etc.) and/or selecting a transition metal precatalyst compound, particularly a nickel compound, where R_1 comprises phenyl that is unsubstituted in one or both ortho positions. In another preferred embodiment, the transition metal compound and the activator (and co-activator if needed) is added to the reactor separately and in the presence of olefin. A preferred feedstock for the oligomerization process is the alpha-olefin, ethylene. But other alpha-olefins, including but not limited to propylene and 1-butene, may also be used alone or

combined with ethylene. Preferred alpha-olefins include any C_2 to C_{40} alpha-olefin, preferably and C_2 to C_{20} alpha-olefin, preferably any C_2 to C_{12} alpha-olefin, preferably ethylene, propylene, and butene, most preferably ethylene. Dienes may be used in the processes described herein, preferably alpha, omega-dienes are used alone or in combination with mono-alpha olefins.

Preferred oligomerization processes may be run in the presence of various liquids, particularly aprotic organic liquids. Preferably the homogeneous catalyst system, ethylene, alpha-olefins, and product are soluble in these liquids. A supported (heterogeneous) catalyst system may also be used, but will form a slurry rather than a solution. Suitable liquids for both homo- and heterogeneous catalyst systems, include alkanes, alkenes, cycloalkanes, selected halogenated hydrocarbons, aromatic hydrocarbons, and in some cases, hydrofluorocarbons. In some cases, the olefin monomer may also function as the solvent. Useful solvents specifically include hexane, toluene, cyclohexane, and benzene.

The instant invention may also be used to obtain mixtures of alpha-olefins containing desirable numbers of carbon atoms. Factor K from the Schulz-Flory theory (see for instance B. Elvers, et al., **Ed. Ullmann's Encyclopedia of Industrial Chemistry**, Vol. A13, VCH Verlagsgesellschaft mbH, Weinheim, 1989, p. 243-247 and 275-276) serves as a measure of these α-olefins' molecular weights. From this theory, $K = n(C_{n+2}\text{ olefin})/n(C_n\text{ olefin})$, where $n(C_n\text{ olefin})$ is the number of moles of olefin containing n carbon atoms, and $n(C_{n+2}\text{ olefin})$ is the number of moles of olefin containing n+2 carbon atoms, or in other words the next higher oligomer of C_n olefin. From this can be determined the weight (mass) fractions of the various olefins in the resulting product. The ability to vary this factor provides the ability to choose the then-desired olefins.

Invention-made alpha-olefins may be further polymerized with other olefins to form more oligomers or even form homopolymers and copolymers of the alpha olefins produced. These polymers may be made by a number of known methods, such as Ziegler-Natta-type polymerization, metallocene catalyzed polymerization, and other methods, see for instance WO 96/23010, see for instance **Angew. Chem., Int. Ed. Engl.**, vol. 34, p. 1143-1170 (1995); European Patent Application, 416,815; and U.S. Patent 5,198,401 for information about metallocene-type catalysts, and J. Boor Jr., **Ziegler-Natta Catalysts and Polymerizations**, Academic Press, New York, 1979 and G. Allen, et al., Ed., **Comprehensive Polymer Science**, Vol. 4, Pergamon Press, Oxford, 1989, pp. 1-108, 409-

412 and 533-584, for information about Ziegler-Natta-type catalysts, and H. Mark, et al., Ed., **Encyclopedia of Polymer Science and Engineering**, Vol. 6, John Wiley & Sons, New York, 1992, p. 383-522, for information about polyethylene.

Preferred oligomerization processes include oligomerizing ethylene to C_4-C_{26} linear alpha-olefins.

Oligomers produced herein may be used as polyolefin feed stocks. They may be used as a mixture of olefins alone, as a mixture of olefins added to other olefins, or they may be separated into fractions and then used alone or in combination with other olefins to form polyolefins. Additionally, alpha-olefins produced herein may be converted to alcohols by known processes, these alcohols being useful for a variety of applications such as intermediates for detergents or plasticizers. Typical processes for the conversion of alpha-olefins to alcohols include, but are not limited to the oxo process followed by hydrogenation, or by a modified, single-step oxo process (the modified Shell process), see for instance B. Elvers, et al., Ed., **Ullmann's Encyclopedia of Chemical Technology**, 5th Ed., Vol. A18, VCH Verlagsgesellschaft mbH, Weinheim, 1991, p. 321-327.

Polymerization Processes

Invention catalyst complexes are useful in polymerizing unsaturated monomers conventionally known to undergo metallocene-catalyzed polymerization such as solution, slurry, gas-phase, and high-pressure polymerization. Typically one or more transition metal compounds, one or more activators, and one or more monomers are contacted to produce polymer. These catalysts may be supported and as such will be particularly useful in the known, fixed-bed, moving-bed, fluid-bed, slurry, solution, or bulk operating modes conducted in single, series, or parallel reactors.

One or more reactors in series or in parallel may be used in the present invention. The transition metal compound, activator and when required, co-activator, may be delivered as a solution or slurry, either separately to the reactor, activated in-line just prior to the reactor, or preactivated and pumped as an activated solution or slurry to the reactor. Polymerizations are carried out in either single reactor operation, in which monomer, comonomers, catalyst/activator/co-activator, optional scavenger, and optional modifiers are added continuously to a single reactor or in series reactor operation, in which the above components are added to each of two or more reactors connected in series. The catalyst components can be added to the first reactor in the series. The catalyst component may also be added to both

reactors, with one component being added to first reaction and another component to other reactors. In one preferred embodiment, the precatalyst is activated in the reactor in the presence of olefin.

Ethylene-alpha-olefin (including ethylene-cyclic olefin and ethylene-alpha -olefin-diolefin) elastomers of high molecular weight and low crystallinity can be prepared utilizing the catalysts of the invention under traditional solution processes or by introducing ethylene gas into a slurry utilizing the alpha-olefin or cyclic olefin or mixture thereof with other monomers, polymerizable and not, as a polymerization diluent in which the catalyst suspension is suspended. Typical ethylene pressures will be between 10 and 1000 psig (69-6895 kPa) and the polymerization diluent temperature will typically be between -10 and 160 °C. The process can be carried out in a stirred tank reactor or a tubular reactor, or more than one reactor operated in series or in parallel. See the general disclosure of U.S. patent 5,001,205 for general process conditions. All documents are incorporated by reference for description of polymerization processes, ionic activators and useful scavenging compounds.

The invention catalyst compositions can be used individually or can be mixed with other known polymerization catalysts to prepare polymer blends. Monomer and catalyst selection allows polymer blend preparation under conditions analogous to those using individual catalysts. Polymers having increased MWD for improved processing and other traditional benefits available from polymers made with mixed catalyst systems can thus be achieved.

Generally, when using invention catalysts, particularly when they are immobilized on a support, the complete catalyst system will additionally comprise one or more scavenging compounds. Here, the term scavenging compound means a compound that removes polar impurities from the reaction environment. These impurities adversely affect catalyst activity and stability. Typically, purifying steps are usually used before introducing reaction components to a reaction vessel. But such steps will rarely allow polymerization without using some scavenging compounds. Normally, the polymerization process will still use at least small amounts of scavenging compounds.

Typically, the scavenging compound will be an organometallic compound such as the Group–13 organometallic compounds of U.S. Patents 5,153,157, 5,241,025 and WO-A-91/09882, WO-A-94/03506, WO-A-93/14132, and that of WO 95/07941. Exemplary

compounds include triethyl aluminum, triethyl borane, tri-*iso*-butyl aluminum, methyl alumoxane, *iso*-butyl alumoxane, and tri-n-octyl aluminum. Those scavenging compounds having bulky or C_6-C_{20} linear hydrocarbyl substituents connected to the metal or metalloid center usually minimize adverse interaction with the active catalyst. Examples include triethylaluminum, but more preferably, bulky compounds such as tri-*iso*-butyl aluminum, tri-*iso*-prenyl aluminum, and long-chain linear alkyl-substituted aluminum compounds, such as tri-n-hexyl aluminum, tri-n-octyl aluminum, or tri-n-dodecyl aluminum. When alumoxane is used as the activator, any excess over that needed for activation will scavenge impurities and additional scavenging compounds may be unnecessary. Alumoxanes also may be added in scavenging quantities with other activators, e.g., methylalumoxane, $[Me_2HNPh]^+[B(pfp)_4]^-$ or $B(pfp)_3$ (perfluorophenyl = pfp = C_6F_5).

In terms of polymer density, the polymers capable of production in accordance the invention, can range from about 0.85 to about 0.95, preferably from 0.87 to 0.93, more preferably 0.89 to 0.920. Polymer molecular weights can range from about 3000 Mn to about 2,000,000 Mn or greater. Molecular weight distributions can range from about 1.1 to about 50.0, with molecular weight distributions from 1.2 to about 5.0 being more typical. Pigments, antioxidants and other additives, as is known in the art, may be added to the polymer.

Gas phase polymerization

Generally, in a fluidized gas bed process used for producing polymers, a gaseous stream containing one or more monomers is continuously cycled through a fluidized bed in the presence of a catalyst under reactive conditions. The gaseous stream is withdrawn from the fluidized bed and recycled back into the reactor. Simultaneously, polymer product is withdrawn from the reactor and fresh monomer is added to replace the polymerized monomer. (See for example U.S. Patent Nos. 4,543,399, 4,588,790, 5,028,670, 5,317,036, 5,352,749, 5,405,922, 5,436,304, 5,453,471, 5,462,999, 5,616,661 and 5,668,228 all of which are fully incorporated herein by reference.)

The reactor pressure in a gas phase process may vary from about 10 psig (69 kPa) to about 500 psig (3448 kPa), preferably from about 100 psig (690 kPa) to about 500 psig (3448 kPa), preferably in the range of from about 200 psig (1379 kPa) to about 400 psig (2759 kPa), more preferably in the range of from about 250 psig (1724 kPa) to about 350 psig (2414 kPa).

The reactor temperature in the gas phase process may vary from about 30 °C to about 120°C, preferably from about 60 °C to about 115 °C, more preferably in the range of from about 70 °C to 110 °C, and most preferably in the range of from about 70 °C to about 95°C. In another embodiment when high density polyethylene is desired then the reactor temperature is typically between 70 and 105 °C.

The productivity of the catalyst or catalyst system in a gas phase system is influenced by the partial pressure of the main monomer. The preferred mole percent of the main monomer, ethylene or propylene, preferably ethylene, is from about 25 to 90 mole percent and the comonomer partial pressure is in the range of from about 138 kPa to about 517 kPa, preferably about 517 kPa to about 2069 kPa, which are typical conditions in a gas phase polymerization process. Also in some systems the presence of comonomer can increase productivity.

In a preferred embodiment, the reactor utilized in the present invention is capable of producing more than 500 lbs of polymer per hour (227 Kg/hr) to about 200,000 lbs/hr (90,900 Kg/hr) or higher, preferably greater than 1000 lbs/hr (455 Kg/hr), more preferably greater than 10,000 lbs/hr (4540 Kg/hr), even more preferably greater than 25,000 lbs/hr (11,300 Kg/hr), still more preferably greater than 35,000 lbs/hr (15,900 Kg/hr), still even more preferably greater than 50,000 lbs/hr (22,700 Kg/hr) and preferably greater than 65,000 lbs/hr (29,000 Kg/hr) to greater than 100,000 lbs/hr (45,500 Kg/hr), and most preferably over 100,000 lbs/hr (45,500 Kg/hr).

Other gas phase processes contemplated by the process of the invention include those described in U.S. Patent Nos. 5,627,242, 5,665,818 and 5,677,375, and European publications EP-A- 0 794 200, EP-A- 0 802 202 and EP-B- 634 421 all of which are herein fully incorporated by reference.

In another preferred embodiment the catalyst system in is liquid form and is introduced into the gas phase reactor into a resin particle lean zone. For information on how to introduce a liquid catalyst system into a fluidized bed polymerization into a particle lean zone, please see US 5,693,727, which is incorporated by reference herein.

Slurry phase polymerization

A slurry polymerization process generally operates between 1 to about 50 atmosphere pressure range (15 psig to 735 psig, 103 kPa to 5068 kPa) or even greater and temperatures in

the range of 0 °C to about 120 °C. In a slurry polymerization, a suspension of solid, particulate polymer is formed in a liquid polymerization diluent medium to which monomer and comonomers along with catalyst are added. The suspension including diluent is intermittently or continuously removed from the reactor where the volatile components are separated from the polymer and recycled, optionally after a distillation, to the reactor. The liquid diluent employed in the polymerization medium is typically an alkane having from 3 to 7 carbon atoms, preferably a branched alkane. The medium employed should be liquid under the conditions of polymerization and relatively inert. When a propane medium is used the process should be operated above the reaction diluent critical temperature and pressure. Preferably, a hexane or an isobutane medium is employed.

In one embodiment, a preferred polymerization technique of the invention is referred to as a particle form polymerization, or a slurry process where the temperature is kept below the temperature at which the polymer goes into solution. Such technique is well known in the art, and described in for instance U.S. Patent No. 3,248,179 which is fully incorporated herein by reference. The preferred temperature in the particle form process is within the range of about 85 °C to about 110 °C. Two preferred polymerization methods for the slurry process are those employing a loop reactor and those utilizing a plurality of stirred reactors in series, parallel, or combinations thereof. Non-limiting examples of slurry processes include continuous loop or stirred tank processes. Also, other examples of slurry processes are described in U.S. Patent No. 4,613,484, which is herein fully incorporated by reference.

In another embodiment, the slurry process is carried out continuously in a loop reactor. The catalyst, as a slurry in isobutane or as a dry free flowing powder, is injected regularly to the reactor loop, which is itself filled with circulating slurry of growing polymer particles in a diluent of isobutane containing monomer and comonomer. Hydrogen, optionally, may be added as a molecular weight control. The reactor is maintained at a pressure of 3620 kPa to 4309 kPa and at a temperature in the range of about 60 °C to about 104 °C depending on the desired polymer melting characteristics. Reaction heat is removed through the loop wall since much of the reactor is in the form of a double-jacketed pipe. The slurry is allowed to exit the reactor at regular intervals or continuously to a heated low pressure flash vessel, rotary dryer and a nitrogen purge column in sequence for removal of the isobutane diluent and all unreacted monomer and comonomers. The resulting hydrocarbon free powder is then compounded for use in various applications.

In another embodiment, the reactor used in the slurry process of the invention is capable of and the process of the invention is producing greater than 2000 lbs of polymer per hour (907 Kg/hr), more preferably greater than 5000 lbs/hr (2268 Kg/hr), and most preferably greater than 10,000 lbs/hr (4540 Kg/hr). In another embodiment the slurry reactor used in the process of the invention is producing greater than 15,000 lbs of polymer per hour (6804 Kg/hr), preferably greater than 25,000 lbs/hr (11,340 Kg/hr) to about 100,000 lbs/hr (45,500 Kg/hr).

In another embodiment in the slurry process of the invention the total reactor pressure is in the range of from 400 psig (2758 kPa) to 800 psig (5516 kPa), preferably 450 psig (3103 kPa) to about 700 psig (4827 kPa), more preferably 500 psig (3448 kPa) to about 650 psig (4482 kPa), most preferably from about 525 psig (3620 kPa) to 625 psig (4309 kPa).

In yet another embodiment in the slurry process of the invention the concentration of predominant monomer in the reactor liquid medium is in the range of from about 1 to 10 weight percent, preferably from about 2 to about 7 weight percent, more preferably from about 2.5 to about 6 weight percent, most preferably from about 3 to about 6 weight percent.

Another process of the invention is where the process, preferably a slurry or gas phase process is operated in the absence of or essentially free of any scavengers, such as triethylaluminum, trimethylaluminum, tri-*iso*-butylaluminum and tri-*n*-hexylaluminum and diethyl aluminum chloride, dibutyl zinc and the like. This process is described in PCT publication WO 96/08520 and U.S. Patent No. 5,712,352, which are herein fully incorporated by reference.

In another embodiment the process is run with scavengers. Typical scavengers include trimethyl aluminum, tri-*iso*-butyl aluminum and an excess of alumoxane or modified alumoxane.

Homogeneous, bulk or solution phase polymerization

The catalysts described herein can be used advantageously in homogeneous solution processes. Generally this involves polymerization in a continuous reactor in which the polymer formed and the starting monomer and catalyst materials supplied, are agitated to reduce or avoid concentration gradients. Suitable processes operate above the melting point of the polymers at high pressures, from 1 to 3000 bar (10-30,000 MPa), in which the monomer acts as diluent or in solution polymerization using a solvent.

Temperature control in the reactor is obtained by balancing the heat of polymerization and with reactor cooling by reactor jackets or cooling coils to cool the contents of the reactor,

auto refrigeration, pre-chilled feeds, vaporization of liquid medium (diluent, monomers or solvent) or combinations of all three. Adiabatic reactors with pre-chilled feeds may also be used. The reactor temperature depends on the catalyst used. In general, the reactor temperature preferably can vary between about 0 °C and about 160 °C, more preferably from about 10 °C to about 140 °C, and most preferably from about 40 °C to about 120 °C. In series operation, the second reactor temperature is preferably higher than the first reactor temperature. In parallel reactor operation, the temperatures of the two reactors are independent. The pressure can vary from about 1 mm Hg to 2500 bar (25,000 MPa), preferably from 0.1 bar to 1600 bar (1-16,000 MPa), most preferably from 1.0 to 500 bar (10-5000MPa).

Each of these processes may also be employed in single reactor, parallel or series reactor configurations. The liquid processes comprise contacting olefin monomers with the above described catalyst system in a suitable diluent or solvent and allowing said monomers to react for a sufficient time to produce the desired polymers. Hydrocarbon solvents are suitable, both aliphatic and aromatic. Alkanes, such as hexane, pentane, isopentane, and octane, are preferred.

The process can be carried out in a continuous stirred tank reactor, batch reactor, or plug flow reactor, or more than one reactor operated in series or parallel. These reactors may have or may not have internal cooling and the monomer feed may or may not be refrigerated. See the general disclosure of U.S. patent 5,001,205 for general process conditions. See also, international application WO 96/33227 and WO 97/22639.

Medium and High Pressure Polymerizations

In the high pressure process for the polymerization of ethylene alone or in combination with C_3 to C_{10} alpha-olefins and optionally other copolymerizable olefins, the temperature of the medium within which the polymerization reaction occurs is at least 120 °C and preferably above 140 °C and may range to 350 °C, but below the decomposition temperature of said polymer product, typically from 310 °C to 325 °C. Preferably, the polymerization is completed at a temperature within the range of 130 °C to 230 °C. The polymerization is completed at a pressure above 200 bar (20 MPa), and generally at a pressure within the range of 500 bar (50 MPa) to 3500 bar (350 MPa). Preferably, the polymerization is completed at a pressure within the range from 800 bar (80 MPa) to 2500 bar (250 MPa).

For medium pressure process, the temperature within which the polymerization reaction occurs is at least 80 °C and ranges from 80 °C to 250 °C, preferably from 100 °C to 220 °C, and should for a given polymer in the reactor, be above the melting point of said polymer so as to maintain the fluidity of the polymer-rich phase. The pressure can be varied between 100 and 1000 bar for ethylene homopolymers and from 30 bar (3 MPa) to 1000 bar (100 MPa), especially 50 bar (5 MPa) to 500 bar (50 MPa) for processes producing ethylene copolymers containing C_3 to C_{10} olefins and optionally other copolymerizable olefins.

More recently, polymerization conditions for high pressure and or temperature polymerizations to prepare propylene homopolymers and copolymers of propylene with C_3 to C_{10} olefins and optionally other copolymerizable olefins have been reported. See US patent applications 60/431,185 filed December 5, 2002; 60/431,077, filed December 5, 2002; and 60/412,541, filed September 20, 2002.

After polymerization and deactivation of the catalyst, the polymer product can be recovered by processes well known in the art. Any excess reactants may be flashed off from the polymer and the polymer obtained extruded into water and cut into pellets or other suitable comminuted shapes. . For general process conditions, see the general disclosure of U.S. patents 5,084,534, 5,408,017, 6,127,497, 6,255,410, which are incorporated herein by reference.

A set of exemplary catalyst precursors is set out below. These are by way of example only and are not intended to list every catalyst precursor that is within the scope of the invention.

Examples of compounds with ligand type L*1 include:
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],
[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dichlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-methoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-ethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-diethoxycatecholate],.

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-propoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dipropoxycatecholate],.

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-butoxyoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibutoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-cyclohexylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*n*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-nitrocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-diethoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dipropoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[2,3-dimethyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-ethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-diethoxycatecholate],.

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-propoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dipropoxycatecholate],.

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-butoxyoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibutoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-cyclohexylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-nitrocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[2-methyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-bromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-ethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-diethoxycatecholate],.

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-propoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dipropoxycatecholate],.

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-butoxyoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*n*-butvl-4,5-dibutoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-*iso*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-butyl-4-cyclohexylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-chlorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-bromocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-fluorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-butyl-6-nitrocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],
[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-dibromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4,5-difluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-methoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-ethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-diethoxycatecholate],.

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-propoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-dipropoxycatecholate],.

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-butoxyoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butvl-4,5-dibutoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-butyl-4-cyclohexylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-butyl-6-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-butyl-6-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-butyl-6-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-butyl-6-nitrocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-dimethylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dichlorocatechlote],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [4-methylcatecholate],

[naphthalene-2,3-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [phenanthrene-9,10-diolate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) catecholate,

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],
[2,3-dimethyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,
[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-bromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,5-dimethylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrachlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrabromocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrafluorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [3,6-dichlorocatechlote],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [4-methylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [naphthalene-2,3-diolate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) [phenanthrene-9,10-diolate],

[1,2-bis-(2,6-dimethylphenylimino)acenaphthene] nickel(II) catecholate,

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],
[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[2,3-dimethyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1-(2,6-dimethylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-propylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-bromocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-dimethylcatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [3,4,5,6-tetrachlorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [3,4,5,6-tetrabromocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [3,4,5,6-tetrafluorocatecholate],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [3,6-dichlorocatechlote],
[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [4-methylcatecholate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [naphthalene-2,3-diolate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] [phenanthrene-9,10-diolate],

[1-(2,6-dimethylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] catecholate,

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*iso*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*n*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*n*-propylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-bromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-dimethylcatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrachlorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrabromocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,5,6-tetrafluorocatecholate],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-dichlorocatechlote],
[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [4-methylcatecholate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [naphthalene-2,3-diolate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [phenanthrene-9,10-diolate],

[2,3-dimethyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) catecholate,

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],
[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],
[2-methyl-3-propyl-1-(2,5-di-*tert*-butylphenyl)-4-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-bromocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibromocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-fluorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-difluorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-ethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-diethoxycatecholate],.

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-propoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dipropoxycatecholate],.

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-butoxyoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butvl-4,5-dibutoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-bromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*tert*-butyl-6-nitrocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dichlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-bromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-difluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-methoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dimethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-ethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-diethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-propoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dipropoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-butoxyoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butvl-4,5-dibutoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4,5-di-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-butyl-4-cyclohexylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-bromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-butyl-6-nitrocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-chlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dichlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-bromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-difluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-methoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dimethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-ethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-diethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-propoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dipropoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-butoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4,5-dibutoxycatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetra-*iso*-propylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*iso*-propyl-4-cyclohexylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*iso*-propylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,6-tri-*n*-propylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-di-*n*-propylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-di-*n*-propylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-chlorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dichlorocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-bromocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibromocatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-fluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-difluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-methoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dimethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-ethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-diethoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-propoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dipropoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4-butoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dimethyl-4,5-dibutoxycatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,5-dimethylcatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,8-tetra-*tert*-butyldibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexachlorodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [1,4,6,7,8,9-hexabromodibenzo[1,4]dioxine-2,3-diolate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrachlorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrabromocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,4,5,6-tetrafluorocatecholate],

[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [3,6-dichlorocatechlote],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [4-methylcatecholate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [naphthalene-2,3-diolate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) [phenanthrene-9,10-diolate],
[1-(2,5-di-*tert*-butylphenylimino)-2-(2,6-di-*iso*-propylphenylimino)acenaphthene] nickel(II) catecholate,
[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,5-di-*tert*-butylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,5-di-*tert*-butylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,5-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,5-di-*tert*-butylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],
[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4,5-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[1,2-bis-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-methyl-2,3-bis-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],

[5-methyl-2,3-bis-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,2-bis-(2,6-di-*iso*-propylphenylimino)-cyclohexane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2,3-bis-(2,6-di-*iso*-propylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1,4-dimethyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-cyclopentane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],
[5-methyl-2,3-bis-(2,6-di-*iso*-propylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,6-dimethylphenylimino)-cyclohexane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-cyclopentane] nickel(II) [3,6-di-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],
[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,6-dimethylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate],
[1-(2,6-di-*iso*-propylphenylimino)-2-(2,5-di-*tert*-butylphenylimino)-cyclohexane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]dithiane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-piperazine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-bicyclo[2.2.1]-heptane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1,4-dimethyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-[1,4]diazepane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[1-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-cyclopentane] nickel(II) [3,6-di-*iso*-propylcatecholate],

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-tetrahydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate], and

[5-methyl-2-(2,6-di-*iso*-propylphenylimino)-3-(2,5-di-*tert*-butylphenylimino)-2,3-dihydrohydrofuran] nickel(II) [3,6-di-*iso*-propylcatecholate].

A similar list of platinum, palladium, cobalt, iron and copper complexes can be generated using the above list by substituting "nickel(II)" with platinum(II), palladium(II), cobalt(II), cobalt(I), iron(II), or copper(I). For example, [1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate] would become:

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] platinum(II) [3,6-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] palladium(II) [3,6-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] cobalt(II) [3,6-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] cobalt(I) [3,6-di-*tert*-butylcatecholate],

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] iron(II) [3,6-di-*tert*-butylcatecholate], or

[1,4-bis-(2,6-di-*iso*-propylphenyl)-1,4-diaza-1,3-butadiene] copper(I) [3,6-di-*tert*-butylcatecholate]. In this list, the transition metal compounds of nickel(II) and palladium(II) are most preferred.

Examples of compounds with ligand type L*2 include:

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butyl catecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butyl catecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,5-di-*tert*-butyl catecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl catecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl catecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butylcatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl catecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-chlorocatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4-chlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4,5-dichlorocatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],
N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4-methoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl -4-methoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldimethylidyne)bis[2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[benzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)[2-methylbenzenamine][2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl - 4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldibenzylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*tert*-butyl - 4,5-dimethoxycatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [4-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [4,5-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [4-cyclohexylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [4-cyclohexylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,4,6-tri-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [3,6-di-*iso*-propylcatecholate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [naphthalene-2,3-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-dimethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-dimethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-di-*iso*-propyl-4-methylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-4-methylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-6-methylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-*iso*-propyl-benzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-triethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2-ethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,6-diethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate], and
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4-diethylbenzenamine] cobalt(I) [phenanthrene-9,10-diolate].

A similar list of platinum, palladium, nickel, iron, copper and cobalt(II) complexes can be generated using the above list by substituting "cobalt(I)" with platinum(II), palladium(II), nickel(II), iron(II), copper(I), or cobalt(II). For example, N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-*tert*-butylcatecholate] would become:
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] platinum(II) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] palladium(II) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] nickel(II) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] iron(II) [3,5-di-*tert*-butylcatecholate],
N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] copper(I) [3,5-di-*tert*-butylcatecholate], or

N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(II) [3,5-di-*tert*-butylcatecholate]. In this list, the transition metal compounds of iron(II), cobalt(I) and cobalt(II) are most preferred.

Examples of compounds with ligand type L*13 include:
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,5-di-*tert*-butyl-catecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-chlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dichlorocatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4-methoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyrimidine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-[1,3,5]-triazine] nickel(II) [3,6-di-*tert*-butyl-4,5-dimethoxycatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*iso*-propylcatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-*is*-propylcatecholate],

[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-4-cyclohexylcatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],

[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,4,6-tri-*iso*-propylcatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propyl-catecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],

[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [3,6-di-*iso*-propylcatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [4-methylcatecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate], [2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],

[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [naphthalene-2,3-diolate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-diethylphenyl)-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,4,6-trimethylphenyl)-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-iminomethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-dimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2-*iso*-propyl-6-methylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-di-*iso*-propylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,6-diethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate],
[2-(N-(2,4,6-trimethylphenyl)-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate], and
[2-(N-(2,6-di-*iso*-propyl-4-methylphenyl)-1-imino-2-ethyl)-pyridine] nickel(II) [phenanthrene-9,10-diolate].

A similar list of platinum, palladium, nickel, iron, copper and cobalt complexes can be generated using the above list by substituting "nickel(II)" with platinum(II), palladium(II), iron(II), copper(I), cobalt (I) or cobalt(II). For example, [2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] nickel(II) [3,6-di-*tert*-butyl-catecholate], would become:
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] platinum(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] palladium(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] iron(II) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] copper(I) [3,6-di-*tert*-butyl-catecholate],
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] cobalt(I) [3,6-di-*tert*-butyl-catecholate],
or
[2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine] cobalt(II) [3,6-di-*tert*-butyl-catecholate].
In this list, the transition metal compounds of nickel(II) and palladium(II) are most preferred.

Experimental – Synthesis of Pre-catalysts

In the following experiments pressure is reported in atomspheres and pounds per square inch. The conversion factors to S. I. Units are; 1 psi equals 6.894757 kPa and 1 atm equals 101.325 kPa.

All experiments were performed under an inert atmosphere unless otherwise specified. Solvents, including NMR solvents were dry and deaerated prior to use. Dicobalt octacarbonyl was purchased from Strem Chemical Company. Nickel carbonyl can also be obtained from Strem Chemical Company. 1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene and [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) dibromide (Ni-Br) were prepared according to literature methods or as described in the experiment (J. Am. Chem. Soc. 1995, 117, 6414 or US 5,880,323). 2,6-bis[1-(2,4,6-trimethylphenylimino)ethyl]pyridine and N,N'-(2,6-pyridinediyldiethylidyne)bis(2,4,6-trimethylbenzenamine] cobalt(II) dichloride (Co-Cl) were synthesized according to literature methods (J. Am. Chem. Soc. 1999, 121, 8728. 2,6-bis[1-(2-methylphenylimino)ethyl]pyridine was purchased from Strem Chemical Company. Titanium tetrachloride, pyrocatechol (catechol), 3,5-di-*tert*-butyl-o-quinone, isobutylene, silver(I) oxide, thallium (dried), mercury, glyoxal (40 wt. % solution in water), pyruvic aldehyde (40 wt.% solution in water), 2,3-hexanedione, 2,3-butanedione (diacetyl), 2-acetylpyridine, 2-pyridinecarboxaldehyde, 2,6-dimethylaniline, 2,6-di-isopropylaniline, 2,5-di-*tert*-butylaniline, 2-isopropyl-6-methylaniline, diethylamine, formic acid, anhydrous magnesium sulfate, anhydrous sodium sulfate, sulfuryl chloride, sodium acetate, manganese(II) acetate, nickel(II) dibromide ethylene glycol dimethyl ether complex ((DME)$NiBr_2$), can be purchased from Aldrich Chemical Company.

Elemental analyses were performed by pyrolysis in closed zone in oxygen stream at 900°C. Determination accuracy for C, H was about 0.3 %. NMR spectra of ligands and transition metal complexes were recorded on a Tesla BS-567 A 100MHz ^{1}H NMR, a Gemini-300 300MHz ^{1}H NMR, or on a Bruker DPX 200 ^{1}H NMR 200 MHz; ^{13}C NMR 50.3 MHz). IR -spectra were recorded on Specord-M80 (Nujol, cm^{-1}).

3,6-di-*tert*-butyl-catechol: A mixture of freshly distilled $TiCl_4$ (11 g, 58 mmol) and pyrocatechol (13.7 g, 0.124 mol) was refluxed in 80 mL of xylene during 20 hours. The resulting dark-brown solid was filtered, washed by xylene and dried under vacuum. Titanium catecholate (10.24 g, 66%) was isolated. This salt (2.3 g, 8.7 mmol), pyrocatechol (82.5 g, 0.749 mol), xylene (80 mL) and isobutylene (150 mL) were heated in autoclave during 1.5 hours at 140 °C. The solvent was removed and the residue was distilled under vacuum (b.p. -140-145 °C, ~ 1mm Hg; m.p. 96-96.5 °C). Yield: 157.4 g (95%). (Also see "Organic Chemistry of Free Radicals", Moscow, Khimia, 1979, p.134.)

3,6-di-*tert*-butyl-1,2-benzoquinone: To 3,6-di-*tert*-butylcatechol (0.222 g, 1.0 mmol) dissolved in 50 mL ether, Ag_2O powder (1.2 g, excess) was added. The mixture was intensively stirred for one hour, and was then allowed to sit a few minutes. The green solution was carefully decanted off; the residue was washed with ether (3×10 mL). Combined solutions were filtered, and partly evaporated to reduce volume. Upon cooling, red-green crystals were formed, and were isolated by filtration. The yield was close to quantitative; m.p. 199-201 °C. (Also see "Organic Chemistry of Free Radicals", Moscow, Khimia, 1979, p.134.)

(3,6-di-*tert*-butyl-catecholate) dithallium: An evacuated ampoule containing 3,6-di-*tert*-butyl-1,2-benzoquinone (0.22 g, 1 mmol) and thallium amalgam (great excess, approx. 10-20:1 molar excess) in tetrahydrofuran ("THF") (~ 50 mL) was strongly shaken until the color became unchanged. (The color changed from deep red-brown to bright yellow.) The light suspension of thallium catecholate was carefully decanted from thallium amalgam. Amalgam was washed by THF till the disappearance of color. Thallium catecholate was used *in situ*. The compound was extremely air sensitive.

3,6-di-*tert*-butyl-4-methoxy-o-quinone: To 3,6-di-*tert*-butyl-o-quinone (11 g, 0.05 mol) in 100 mL of methanol were added dry manganese(II) acetate (4.4 g, 0.025 mol) and dry sodium acetate (0.5 g). The mixture was stirred. During this time, the color changed from red to brown. The reaction progress was monitored by thin-layer chromatography using "Silufol" plates (Silufol UV 254 from Kavalier in the Czech

Republic). Eluent: n-hexane/ether (100/1). Upon reaction completion, the mixture was filtered, methanol was removed, and the solid residue was recrystallized from n-hexane. The product was isolated as dark-red plates; m.p. 98°C, yield 78%. (Also see Izv.Acad.Nauk SSSR, Ser.Khim., 12 (1980) 2707.)

3,6-di-*tert*-butyl-4,5-di-methoxy-o-quinone: This compound was obtained similarly to 3,6-di-*tert*-butyl-4-methoxy-o-quinone. Additionally, air was bubbled into the mixture to help promote the reaction of the 3,6-di-*tert*-butyl-4-methoxy-o-quinone (initial product formed) to the 3,6-di-*tert*-butyl-4,5-di-methoxy-o-quinone. According to thin-layer chromatography, the maximum concentration of the product was achieved after about 7 days. The solvent was removed; the solid residue was dissolved in n-hexane/ether (100/1) mixture and separated through silica-gel column (Silochrome C-120, 0.25-0.35 mm, from Reachim in Russia). Eluent: n-hexane/ether (100/1). The bright red zone was isolated and concentrated. After cooling bright-red needle-like crystals were obtained; m.p. 76-77°C, yield 35%. ^1H NMR (CD_3Cl, (200 MHz, δ, ppm): 1.3 s (18H, Bu^t); 3.77 s (6H, OCH_3).

3,6-di-*tert*-butyl-4-chloro-o-quinone: SO_2Cl_2 (25 mmol) was slowly added to a chilled solution of 3,6-di-*tert*-butyl-o-quinone (10 mmol) in 15 mL of ether. The reaction was exothermic, hence, the reaction was chilled using a cold water bath to maintain the reaction at or near room temperature. The reaction mixture was stirred until the quinone color disappeared, and then was washed with aliquots of water until neutral, and dried over Na_2SO_4. The dried solution was separated from the Na_2SO_4. The ether was removed, and the solid residue was recrystallized from n-heptane. Light-yellow crystals of 3,6-di-*tert*-butyl-5,6-dichloro-cyclohex-3-ene-dione-1,2 were isolated. The mentioned product (10 mmol) was mixed with Et_2NH (12 mmol) in n-pentane. The formed residue ($Et_2NH_2^+Cl^-$) was removed, and the mother solution was allowed to sit for one hour. The solution was then washed with aliquots of water until neutral, and dried over Na_2SO_4. The dried solution was separated from the Na_2SO_4. Upon partial evaporation and cooling, deep-red crystals were formed; m.p. 50°C. ^1H NMR (CD_3Cl, (200 MHz, δ, ppm): 1.25 s (9H, Bu^t); 1.40 s (9H, Bu^t); 6.66 s (1H, arom.). (Also see Izv.Acad.Nauk SSSR, Ser.Khim., 12 (1985) 2793.)

3,6-di-*tert*-butyl-4,5-di-chloro-o-quinone: This compound was obtained similarly to 3,6-di-*tert*-butyl-4-chloro-o-quinone, using the same general reaction conditions and work-up/isolation techniques described above. 3,6-di-*tert*-butyl-4-chloro-o-quinone was reacted with excess SO_2Cl_2 in chilled ether to produce of 3,6-di-*tert*-butyl-4,5,6-trichloro-cyclohex-3-ene-dione-1,2 which was isolated in a manner analogous to of 3,6-di-*tert*-butyl-,5,6-dichloro-cyclohex-3-ene-dione-1,2 described above. This product was reacted with a slight excess of Et_2NH in pentane. The formed residue ($Et_2NH_2^+Cl^-$) was removed. The solution was then washed with aliquots of water until neutral, and dried over Na_2SO_4. The dried solution was separated from the Na_2SO_4. Partial evaporation and cooling produced a solid that was recrystallized from n-hexane at 0 °C. Deep-red crystals; m.p. 48 °C. ^1H NMR (CD_3Cl, (200 MHz, δ, ppm): 1.41 s (18H, Bu^t).

Nickel Complexes: General synthetic procedure for compounds Ni-1, Ni-2, Ni-3, Ni-4 and Ni-5: Nickel tetracarbonyl (0.171 g, 1 mmol) was condensed into an evacuated ampoule (approximately 200 mL volume) containing the corresponding 1,2-benzoquinone (1 mmol) and diazabutadiene (1 mmol) in 20 mL of degassed toluene. The ampoule was slowly warmed at about 30 °C for one half hour and at about 80 °C for the next two hours. During this period, it was necessary to freeze and evacuate the ampoule periodically every ten minutes to remove CO (a side product of the reaction). After this time period, the resulting solution was allowed to stay overnight at −10 °C in the ampoule. Crystalline solid was filtered, washed with light petroleum ether and dried under vacuum. Yields and compound properties are listed below.

Ni-1 [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate].

The general procedure described above yielded dark green air stable crystals. Yield 0.426 g (65%). IR (Nujol, cm^{-1}): 1590 w, 1550 w, 1370 m, 1360 m, 1320 s, 1305 s, 1275 s, 1260 s, 1210 s, 1180 s, 1040 s, 985 s, 940 m, 870 m, 860 m, 785 s, 750 s, 700 s, 655 s, 620 m, 595 m, 5 15 m, 490 w. Anal.(%) Found: C 72.94; H 8.79; Ni 8.95. $C_{40}H_{56}N_2O_2Ni$ Calc.: C 73.28; H 8.55; Ni 9.01. The complex was soluble in

THF, CH_2Cl_2 and Et_2O, was moderately soluble in toluene, and was insoluble in light petroleum ether.

Ni-2 [1,4-bis-(2,6-di-isopropvlphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dichlorocatecholate].

The general procedure described above yielded dark green, air stable crystals. Yield 0.47 g (65%). IR (Nujol, cm^{-1}): 1590 w, 1565 w, 1545 w, 1400, 1370 s, 1330 s, 1305 m, 1260 s, 1240 s, 1220 s, 1180 s, 1035 s, 990 m, 865 m, 850 m, 800 m, 755 m, 700 m, 670, 600, 515. The complex was soluble in THF, CH_2Cl_2, Et_2O and toluene, and was insoluble in light petroleum ether.

Ni-3 [1,4-bis-(2,6-di-isopropylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butvl-4,5-dimethoxycatecholate].

The general procedure described above yielded brown-green, air stable crystals. Yield 0.5 g (70%). IR (Nujol, cm^{-1}):1560 w, 1530 w, 1500, 1395, 1370 s, 1330 m, 1285 s, 1230 s, 1180 s, 1150 m,1115 m, 1090,1045 s, 1025 m, 1005 m, 885 m,870 m,760, 730 s, 705 m, 690 m, 600 w, 575 w, 5 15 m. The complex was soluble in THF, CH_2Cl_2, Et_2O and toluene, and was insoluble in light petroleum ether.

Ni-4 [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butylcatecholate].

The general procedure described above yielded yellow-green crystals. Yield 0.265 g (40%). IR (Nujol, cm^{-1}): 1590 m, 1530 m, 1475 vs, 1440 s, 1400,1365 s, 1360 s, 1325 s, 1300 s, 1250 m, 1205 m, 1180 s, 1110,1060 m, 1040 s, 1025, 990, 920, 870 m, 845, 830, 800, 760 m, 705, 660, 605, 525. The complex was soluble in THF, CH_2Cl_2, toluene, and was moderately soluble in light petroleum ether.

Ni-5 [2,3-dimethyl-1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate].

The general procedure described above yielded dark green, air stable crystals. Yield 0.546 g (80%). IR (Nujol, cm^{-1}): 1595 w, 1580 w, 1505 s, 1405 s, 1370 m, 1345 s, 1320 s, 1305 s, 1275 s, 1215 s, 1065 w, 985 s, 950 m, 890 w, 880 w, 835 w, 785 m, 740 m, 7 15 w, 705 w, 655 620 m, w, 5 15 w. The complex was soluble in THF, CH_2C_{l2}, Et_2O and toluene, and was insoluble in light petroleum ether.

Ni-6 [l,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl- catecholate] from [l,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) dibromide and (3,6-di-*tert*-butyl-catecholate) dithallium.

A glyoxal solution (9.5 mL, 40 wt.% in water, 0.08 mol) was slowly added at 0 °C to a stirring solution of 20 mL (0. 16 mol) 2,6-dimethylaniline in 50 mL of methanol containing two drops of formic acid as a catalyst. The mixture was stirred four hours and cooled. The crystalline product was filtered, washed with methanol and dried in air. After recrystallization from n-heptane, yellow crystals of 1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene were obtained. Yield 12.8 g (60%). M.p. 153-155 °C. Anal. (%) Found: C 81.51; H 7.41; $C_{18}H_{20}N_2$ Calc.: C 81.82; H 7.58. ^{1}H NMR ($CDC1_3$, δ, ppm): 2.17 s (12 H, CH_3Ph), 6.96-7.01 m (2H, p-CH(Ph)), 7.06-7.10 d (4H, m-CH(Ph)), 8.11 s (2H, -CH=N-). IR (Nujol): ν(C=N) 1630 cm^{-1}.

A solution of 1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene (0.27 g, 1.0 mmol) in 20 mL THF was added to $(DME)NiBr_2$, (0.31 g, 1.0 mmol) suspended in 20 mL THF. The reaction mixture was warmed at about 60 °C over one day until the precipitate disappeared. Deep-brown crystals were filtered, washed with cold, light petroleum ether, and dried in vacuum. Yield 0.29 g (60%). IR (Nujol, cm^{-1}): ν(C=N) 1630 cm^{-1}.

To 0.48 g (1 mmol) of [1,4-bis-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) dibromide in 20 mL THF, a suspension of (3,6-di-*tert*-butyl-catecholate) dithallium in 20 mL THF was added. The mixture was refluxed for one hour. The solvent was then changed to CH_2Cl_2/hexane (1/1). The solution was filtered, reduced in volume, and chilled for 10 hours. The resulting dark green solid

was filtered, washed with cold hexane, and dried in vacuum. Yield 0.30 g (55%). Anal.(%) Found: C 71.50; H 7.81; Ni 10.56. $C_{32}H_{40}N_2O_2Ni$ Calc.: C 70.73; H 7.42; Ni 10.80. IR (Nujol, cm^{-1}): 1720, 1600, 1555, 1460, 1360, 1320 s, 1305 s, 1245, 1205 s. The complex was air stable, and was soluble in THF, CH_2Cl_2, and was slightly soluble in toluene.

Ni-6 [l,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene] nickel(II) [3,6-di-*tert*-butyl- catecholate] from [l,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene], 3,6-di-*tert*-butyl-1,2-benzoquinone and nickel tetracarbonyl.

Nickel-tetracarbonyl (0.704 g, 4.12 mmol) was condensed into evacuated frozen ampoule (of approximately 500 mL volume) containing l,4-bis-(2,6-dimethylphenyl)-l,4-diaza-l,3-butadiene (1.056 g, 4.0 mmol) and of 3,6-di-*tert*-butyl-1,2-benzoquinone (0.88 g, 4.0 mmol) in 100 mL of degassed THF. The ampoule was carefully warmed at ~ 30 °C for one half hour, and at ~ 60 °C for the next two hours. It was necessary to freeze and evacuate the ampoule periodically for removing CO. Afterwards, the solvent was removed. The solid residue was recrystallized from mixture light petroleum ether/CH_2Cl_2 (~ 2 to 1), yielding 0.43 g (65%) of product. 'H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.94 s (18 H, $C(CH_3)_3$); 2.48 s (12 H, (CH_3)); 6.22 s (2H, Ar-Cat); 7.14 - 7.27 m (6H, C_6H_3); 7.88 s (2H, -CH=N-).

Ni-7 [2,3-dimethyl-1,4-diphenyl-1,4-diaza-1,3-butadiene] nickel(II) [3,5-di-*tert*-butyl-catecholate]

A diacetyl solution (4.4 mL, 0.05 mol in 10 mL MeOH) was slowly added at 0°C upon stirring to the solution of 10.0 mL (0.11 mol) aniline in 50 mL of methanol containing two drops of formic acid. The mixture was stirred twenty hours and cooled down to -20°C. The crystalline product, 2,3-dimethyl-1,4-diphenyl-1,4-diaza-1,3-butadiene, was filtered, washed with cold methanol and dried in air. After recrystallization from n-heptane yellow crystals were obtained. Yield 7.5 g (63.5%). IR (Nujol, cm^{-1}): 1640 m, 1600, 1485, 1410 m, 1365 m, 1215, 1120, 1080, 905, 815, 765 s, 700 s. ^1H NMR (200 MHz, $CDCl_3$, δ, ppm): 2.15 s (6H, CH_3); 6.79 d (4H, J= 7.3 Hz, 2-H); 7.11 t (J= 7.4 Hz, 4-H); 7.37 t (4H, J= 7.5 Hz, 3-H). ^{13}C NMR (50

MHz, $CDCl_3$, δ, ppm): 15.40 ($-CH_3$); 118.75 (2-CH); 123.83 4-CH); 128.99 (3-CH); 150.94 (1-C); 168.29 (C=N).

Nickel tetracarbonyl (0.86 g, 5 mmol) was condensed into an evacuated ampoule (having reserved volume of approximately 1litre) and containing frozen 2,3-dimethyl-1,4-diphenyl-1,4-diaza-1,3-butadiene (1.11 g, 5 mmol) and 3,5-di-*tert*-butyl-1,2-benzoquinone (1.10 g, 5 mmol) in 100 mL of degassed toluene. The ampoule was slowly warmed at ~30 °C for one hour and at ~60 °C for the next two hours. Resulting solution was maintained at –10 °C overnight. Dark green crystals were filtered, washed with light petroleum ether, and dried under vacuum. Yield 1.826 g (65%). IR (Nujol, cm^{-1}): 1585, 1515 m, 1490 m, 1420, 1390, 1340 m, 1300 s, 1265 m, 1250, 1215, 1075, 985 s, 850 m, 830, 765 s, 730, 695 s, 655, 625, 525. ^1H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.94 and 1.11 s (2×9H, $C(CH_3)_3$); 1.78 s (6H, $N{=}CCH_3$); 7.27- 7.50 m (10H, $2{\times}C_6H_5$).

Ni-8 [2-methyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-catecholate]

A pyruvic aldehyde water solution (12 mL, 40 wt.%, 78 mmol) was dropwise added to a methanol (50 mL) solution of 2,6-dimethylaniline (20 g, 165 mmol) and 0.5 mL formic acid with stirring. Light petroleum ether (100 mL) was then added, and the mixture was stirred for 4 hours. The petroleum ether layer was separated, partly evaporated and cooled. The yellow solid was recrystallized from n-hexane to give the yellow crystalline product, 2-methyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene (4.8 g, 22%). 'H NMR (200 MHz, $CDCl_3$, δ, ppm): 2.03 s (3H, $N{=}CCH_3$); 2.04 s (6H, 2',6'-CH_3); 2.18 s (6H, 2,6-CH_3); 6.90-7.15 m (6H, $2xC_6H_3$); 8.05 s (1 H, N=CH). ^{13}C NMR (50.3 MHz, $CDCl_3$, δ, ppm): 15.16 ($N{=}C\underline{C}H_3$); 17.90 and 18.35 (2,6- and 2',6'-$C\underline{C}H_3$); 123.77 and 124.61 (4- and 4'-CH); 124.84 and 126.64 (2,6- and 2',6'-C); 148.21 and 149.76 (1- and 1'-C); 164.67 (N=CH); 167.97 ($N{=}\underline{C}Me$).

To a frozen solution of 2-methyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene (0.331 g, 1.19 mmol) and 3,6-di-*tert*-butyl-1,2-benzoquinone (0.262 g, 1.19 mmol) in 30 mL of THF in an evacuated ampoule, $Ni(CO)_4$ (2.03 g, 1.19 mmol) was condensed. The mixture was warmed at 60 °C during a two hour period with CO

periodically being removed. After this time period, the THF was removed leaving behind a solid residue which was dissolved in toluene. The slow addition of n-hexane lead to the formation of a green microcrystalline solid which was isolated by filtration. The product yield was 0.31 g (46.8%). ^{1}H NMR (200 MHz, $CDCl_3$, δ, ppm): 1.25 s (18H, 2x$C(CH_3)_3$); 1.6 s (3H, N=CCH_3); 2.44 s (6H, 2,6-CH_3); 2.50 s (6H, 2',6'-CH_3); 6.18 s (2H, 4,5-H), 7.15-7.22 m (6H, 2x(3,4,5-H); 7.88 s (1H, N=CH).

Ni-9 [2-methyl-3-propyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-catecholate]

2,3-Hexanedione (4.0 mL, 33 mmol) was slowly added to the mixture of 2,6-dimethylaniline (10 g, 80 mmol) and 0.2 mL formic acid in 25 mL of methanol. The mixture was stirred for 6 hours. After this time period, the solvent and excess of aniline were removed under vacuum. The residual viscous oil was dissolved in n-pentane and cooled to give a yellow solid which was recrystallized from n-pentane. The product, 2-methyl-3-propyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene was isolated as yellow crystals (1.9 g, 18%). ^{1}H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.84 t (3H, J=7.28 Hz, $(CH_2)_2\underline{CH_3}$); 1.52 m (2H, $CH_2\underline{CH_2}CH_3$); 2.03 s (3H, N=CCH_3); 2.05 s and 2.06 s (6H and 6H, 2,6- and 2',6'-CH_3); 2.50 m (2H, $\underline{CH_2}CH_2CH_3$); 6.89-7.15 m (6H, 2xC_6H_3). ^{13}C NMR (50.3 MHz, $CDCl_3$, δ, ppm): 14.59 ($CH_2CH_2\underline{C}H_3$); 16.38 (N=$C\underline{C}H_3$); 17.96 and 18.03 (.2,6- and 2',6'-CCH_3); 20.28 ($CH_2\underline{C}H_2CH_3$); 31.24 ($\underline{C}H_2CH_2CH_3$); 123.13 and 123.18 (4- and 4' -CH); 124.67 and 124.75 (2,6 and 2',6'-C); 127.94 and 127.98 (3,5- and 3',5' -CH); 147.99 (1' -C); 148.51 (1 -C); 167.61 (N=$\underline{C}$Me); 171.52 (N=$\underline{C}$Pr).

To a frozen solution of 2-methyl-3-propyl-1,4-bis(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene (0.412 g, 1.29 mmol) and 3,6-di-*tert*-butyl-1,2-benzoquinone (0.283 g, 1.29 mmol) in 30 mL of toluene in an evacuated ampoule, $Ni(CO)_4$ (2.2 g, 1.29 mmol) was condensed. The mixture was warmed at 80 °C during a two hour period with CO periodically being removed. After this time period, the toluene was removed, and the remaining residue was recrystallized from a mixture of CH_2Cl_2/light petroleum ether (~ 1/1). A green microcrystalline solid was isolated (0.23 g, 30%). ^{1}H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.86 m and 0.88 s (21H, $CH_2CH_2\underline{CH_3}$ and

$2xC(CH_3)_3$); 1.36 m (2H, $CH_2C\underline{H}_2CH_3$); 1.63 s (3H, $N{=}CCH_3$); 2.06-2.14 m (2H, $C\underline{H}_2CH_2CH_3$); 2.43 s and 2.47 s (6H and 6H, 2,6-CH_3); 6.14 s (2H, 4,5-H); 7.11-7.24 m (6H, 2x(3,4,5-H)).

Ni-10 [2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butyl-catecholate]

Diacetyl (4.53 g, 52 mmol) was added dropwise to solution of 2,6-di-isopropyl-aniline (9.4 g, 52 mmol) in 50 mL light petroleum ether with stirring and in presence of $MgSO_4$ (anhydrous). Reaction was initiated by 3-5 drops of formic acid and carried out 8-10 hours. The reaction mixture was then filtered. All volatile components were evaporated from the filtrate under vacuum yielding the product, 3-(N-2,6-di-isopropylphenyl)imino-butanone-2, as a yellow oil. Yield 8.6 g (75%). ^1H NMR (200 MHz, $CDCl_3$, δ, ppm): 1.13 and 1.14 (d and d, 2x6H, $CH(C\underline{H}_3)_2$, J= 6.9 Hz); 1.82 (s, 3H, CH_3); 2.59 (s, 3H, CH_3); 2.72 (sept, 2H, $CHMe_2$, J= 6.9 Hz); 7.06 - 7.20 (m, 3H, C_6H_3).

2,6-Di-methylaniline (0.54 g 4.4 mmol) was added to solution of 3-(N-2,6-di-isopropylphenyl)imino-butanone-2 (1.1 g, 4.4 mmol) in 50 mL MeOH with stirring. Two drops of formic acid were added to initiate reaction which took place over three days. Volatile components were removed under vacuum producing the product, 2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene, as a yellow oil (0.71 g, 38%). ^1H NMR (200 MHz, $CDCl_3$, δ, ppm): 1.18 and 1.19 (d and d, 2x6H, $CH(C\underline{H}_3)_2$, J= 6.9 Hz); 2.05 (s, 9H, $CH_3C{=}N$ and Me_2Ar); 2.07 (s, 3H, $CH_3C{=}N$); 2.70 (sept, 2H, $CHMe_2$, J= 6.9 Hz); 6.90 - 7.20 (m, 6H, i-$Pr_2C_6H_3$ and $Me_2C_6H_3$).

To a frozen solution of 2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,6-dimethylphenyl)-1,4-diaza-1,3-butadiene (0.602 g, 2.7 mmol) and 3,6-di-*tert*-butyl-1,2-benzoquinone (0.952 g, 2.7 mmol) in 70 mL of THF in an evacuated ampoule was condensed $Ni(CO)_4$ (0.468 g, 2.7 mmol). The mixture was allowed to stay for a night; CO was removed periodically. After this time period, the THF was removed leaving a residue. The residue was recrystallized from a mixture of CH_2Cl_2/n-hexane (~ 1/1) and yielded the product as a green microcrystalline solid (1.52 g, 90%). ^1HNMR (200 MHz, $CDCl_3$, δ, ppm): 0.88 (s, 18H, $C(CH_3)_3$); 1.19 and

1.49 (d and d, 2x6H, $CH(C\underline{H}_3)_2$, J= 6.8 Hz); 1.64 and 1.69 (s and s, 2x3H, $CH_3C{=}N$), 2.43 (s, 6H, $(C\underline{H}_3)_2Ar$); 3.34 (sept, 2H, $C\underline{H}Me_2$); 6.13 (s, 2H, Ar-Cat); 7.06 -7.42 (m, 6H, $i\text{-}Pr_2C_6H_3$ and $Me_2C_6H_3$).

Ni-11 [2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,5-di-*tert*-butylphenyl)-1,4-diaza-1,3-butadiene]nickel(II) [3,6-di-*tert*-butyl-catecholate]

2,5-Di-*tert*-butylaniline (0.92 g, 4.4 mmol) was added to solution of 3-(N-2,6-di-isopropylphenyl)imino-butanone-2 (1.1 g, 4.4 mmol) in 50 mL MeOH with stirring. Two drops of formic acid were added to initiate reaction which took place over two days. Volatile components were remove under vacuum, yielding the product, 2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,5-di-*tert*-butylphenyl)-1,4-diaza-1,3-butadiene, as a yellow-brown oil (0.7.5 g, 49%). ^{1}H NMR (200 MHz, $CDCl_3$, δ, ppm): 1.18 (d, 12H, $CH(C\underline{H}_3)_2$, J= 6.8 Hz); 1.33 (s, 18H, $(CH_3)_3C$); 2.07 and 2.20 (s and s, 2x3H, $CH_3C{=}N$); 2.72 (sept, 2H, $CHMe_2$, J= 6.8 Hz); 6.55 (d, 1H, o-H, J= 2.1 Hz); 7.06 - 7.20 (m, 4H, $i\text{-}Pr_2C_6H_3$ and p-H); 7.35 (d, 1H, m-H, J=8.2 Hz).

To a frozen solution of 2,3-dimethyl-1-(2,6-di-isopropylphenyl)-4-(2,5-di-*tert*-butylphenyl)-1,4-diaza-1,3-butadiene (1.1 g, 2.5 mmol) and 3,6-di-*tert*-butyl-1,2-benzoquinone (0.518 g, 2.3 mmol) in 70 mL of THF in an evacuated ampoule was condensed $Ni(CO)_4$ (0.403 g, 2.3 mmol). The mixture was allowed to stay for a night; CO was removed periodically. After this time period, THF was removed leaving a residue. The residue was recrystallized from mixture CH_2Cl_2/n-hexane (~ 1/1) to yield the product as a green microcrystalline solid (1.13 g, 69%). ^{1}H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.89 and 0.92 (s and s, $C(CH_3)_3$-Cat); 1.12, 1.24, 1.46 and 1.47 (all d, $(C\underline{H}_3)_2CH$, J= 7 Hz); 1.36 and 1.60 (s and s, $C(CH_3)_3$-ArN); 1.69 and 1.72 (s and s, 2x3H, $CH_3C{=}N$); 3.23 and 3.61 (sept and sept, $CHMe_2$); 6.11 (s, 2H, Ar-Cat); 7.12 (d, 1H, o-H, J= 2.2 Hz); 7.22 - 7.39 (m, 4H, $i\text{-}Pr_2C_6H_3$ and p-H); 7.46 (d, 1H, m-H, J=8.5 Hz).

Ni-12 2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine nickel(II) [3,6-di-*tert*-butyl-catecholate]

A mixture of 2-pyridine-carboxaldehyde (10 ml, 0.1 mole), 2,6-dimethylaniline (12.9 ml, 0.1 mole), 3 drops of formic acid and 30 ml methanol was

stirred for five hours. The methanol was removed under vacuum. An oil-like residue was recrystallized from n-hexane. 2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine was isolated as yellow crystals. Yield: 13.6 g (62 %). ^{1}H NMR (200 MHz; $CDCl_3$; δ, ppm; J, Hz): 2.17 s (6H, CH_3), 6.94-7.12 m (3H, C_6H_3), 7.39 d,d,d (1H, H(5) $^3J_{4,5}$=7.5, $^3J_{5,6}$=4.9, $^4J_{3,5}$=1.3); 7.83 t,d,d (1H, H(4) ^{3}J=7.7, $^4J_{4,6}$=1.8, ^{5}J=0.6); 8.28 d,t (1H, H(3) $^3J_{3,4}$=7.9, J=1.1); 8.35 s (1H, HC=N); 8.71 d,d,d (1H, H(6) $^3J_{5,6}$=4.9, $^4J_{4,6}$=1.6, $^5J_{3,6}$=1.0). ^{13}C NMR, DEPT (50 MHz; $CDCl_3$; δ, ppm): 18.3 (CH_3), 121.2 (C(3)H), 124.0 (C(4')H), 125.3 (C(5)H), 126.8 (C(2',6')), 128.1 (C(3',5')H), 136.7 (C(4)H), 149.6 (C(6)H), 150.3 (C(1')), 154.4 (C(2)), 163.4 (HC=N).

Equimolar amounts of 3,6-di-*tert*-butylquinone (0.18 g, 0.83 mmol), 2-(N-(2,6-dimethylphenyl)-iminomethyl)-pyridine (0.17 g, 0.83 mmol) and nickel tetracarbonyl (0.143 g, 0.83 mmol) were combined in a frozen evacuated ampoule. THF (~ 50 mL) was condensed in the ampoule. The mixture was carefully warmed. Gas (CO) evolution was observed. The ampoule was periodically frozen and evacuated to remove evolved CO gas. After there was no longer any evolution of CO, the solvent was removed. The remaining residue was recrystallized from CH_2Cl_2/n-hexane (1/2) giving 0.21 g of the dark blue colored product (52.5% yield). ^{1}H NMR (200 Mz, $CDCl_3$, δ, ppm; J, Hz): 0.89 and 1.46 s (9H, $C(CH_3)_3$); 2.50 s (6H, $Ar(CH_3)_2$); 6.21 m (2H, $O_2C_6\underline{H}_2(Bu^t)_2$, J=8.0 Hz); 7.05-7.22 m (3H, (3')H, (4')H and (5')H); 7.56 d (1H, (3)H, $^3J_{3,4}$=7.8 Hz); 7.65 t (1H, (5)H, ^{3}J=6.6 Hz); 7.96 t,d (1H, (4)H, ^{3}J=7.8 Hz, J=1.5 Hz); 8.00 s (1H, HC=N); 9.16 d (1H, (6)H, $^3J_{5,6}$=5.5 Hz). ^{13}C NMR (50 MHz, $CDCl_3$, δ, ppm): 18.7 ($Ar(\underline{C}H_3)_2$); 28.9 and 29.9 ($C(\underline{C}H_3)_3$); 33.3 and 33.8 ($\underline{C}Me_3$); 111.2; 112.0; 125.0; 126.7; 127.1; 128.0 ((3')C and (5')C); 130.4 ((2'C and (6')C); 133.6; 134.1; 137.4; 145.9; 150.4; 152.5; 159.4; 160.4; 160.8.

Ni-13 2-(N-(2-*iso*-propyl-6-methylphenyl)-iminomethyl)-pyridine nickel(II) [3,6-di-*tert*-butyl-catecholate]

A mixture of 2-pyridine-carboxaldehyde (8.5 ml, 0.052 mole), 2-*iso*-propyl-6-methylaniline (5 ml, 0.052 mole), 3 drops of formic acid and 30 ml methanol was stirred for five hours. The methanol was removed under vacuum. An oil-like residue was recrystallized from n-hexane. 2-(N-(2-iso-propyl-6-methylphenyl)-iminomethyl)-pyridine was isolated as yellow crystals. Yield: 10.25 g (82.8 %). ^{1}H NMR (200 MHz; $CDCl_3$; δ, ppm; J, Hz): 1.18 d (6H, $CH(C\underline{H}_3)_2$, J=6.9), 2.15 s (3H, CH_3), 3.03

sept. (1H, C$\underline{H}$Me$_2$, J=6.9), 7.01-7.21 m (3H, C_6H_3), 7.41 d,d,d (1H, H(5) $^3J_{4,5}$=7.5, $^3J_{5,6}$=4.9, $^4J_{3,5}$=1.3); 7.85 t,d,d (1H, H(4) ^3J=7.7, $^4J_{4,6}$=1.8, ^5J=0.6); 8.28 d,t (1H, H(3) $^3J_{3,4}$=7.9, J=1.1); 8.33 s (1H, HC=N); 8.73 d,d,d (1H, H(6) $^3J_{5,6}$=4.9, $^4J_{4,6}$=1.6, $^5J_{3,6}$=1.0). ^{13}C NMR, DEPT (50 MHz; $CDCl_3$; δ, ppm): 18.6 (CH_3), 23.3 (CH($\underline{C}H_3)_2$), 27.9 ($\underline{C}$HMe$_2$), 121.3 (C(3)H), 123.2 and 124.3 (C(3')H and C(5')H), 125.4 (C(5)H), 126.1 (C(6')Me), 128.0 (C(4')H), 136.7 (C(4)H), 137.9 (C(2')*i*-Pr), 149.3 (C(1')), 149.7 (C(6)H), 154.4 (C(2)), 163.4 (HC=N).

Equimolar amounts of 3,6-di-*tert*-butylquinone (0.668 g, 3.0 mmol. 2-(N-(2-iso-propyl-6-methylphenyl)-iminomethyl)-pyridine (0.809 g, 3.0 mmol) and nickel tetracarbonyl (0.52 g, 3.0 mmol) were combined in a frozen evacuated ampoule. THF (~150 mL) was condensed in the ampoule. The mixture was carefully warmed. Gas (CO) evolution was observed. The ampoule was periodically frozen and evacuated to remove evolved CO gas. After there was no longer any evolution of CO, the solvent was removed. The remaining residue was recrystallized from THF giving 0.85 g of the dark blue colored product (54.8% yield). ^{1}H NMR (200 Mz, $CDCl_3$, δ, ppm): 0.90 and 1.47 both s (9H, C($CH_3)_3$); 1.17 and 1.41 both d (3H, C$\underline{H}_3$CHCH$_3$ and CH$_3$CHC$\underline{H}_3$, J=6.9 Hz); 2.58 s (3H, (6)CCH$_3$); 3.44 sept (1H, CHMe$_2$, J=6.9 Hz); 6.22 m (2H, O_2C6H_2(*t*-Bu)$_2$, J=8.3 Hz); 7.05-7.31 m (3H, (3', 4' and 5')H); 7.60 d (1H, (3)H, $^3J_{3,4}$=7.6); 7.65 t (1H, (5)H, ^3J=5.9); 7.97 t,d (1H, (4)H, ^3J=7.8, J=1.4); 8.01 s (1H, HC=N); 9.19 d (1H, (6)H, $^3J_{5,6}$=5.4). ^{13}C NMR DEPT (50 Mz, $CDCl_3$, δ, ppm): 19.2, 24.7 and 28.5 (CH_3), 29.1 and 29.9 (C($\underline{C}H_3)_3$), 31.6 ($\underline{C}$Me$_2$), 33.3 and 33.8 ($\underline{C}$Me$_3$), 111.2 (CH), 111.9 (CH), 123.4 (CH), 124.9 (CH), 126.6 (CH), 127.5 (CH), 127.7 (CH), 130.7, 133.5, 134.2, 137.4 (CH), 140.5, 144.7, 150.5 (CH), 152.4, 159.5, 160.5, 160.6 (HC=N).

Ni-14 2-(N-(2,5-di-*tert*-butylphenyl)-1-imino-2-ethyl)-pyridine nickel(II) [3,6-di-*tert*-butyl-catecholate]

An evacuated ampoule containing 2.46 g (12.0 mmole) 2,5-di-*tert*-butylaniline and 1.5 ml (excess 20%) 2-acetylpyridine was heated at 150 °C for five hours. After removal of H_2O, a yellow-brown oil-like product was obtained. According to ^{1}H NMR spectrum it contains ~25 % of the initial acetylpyridine. Because we were unable to isolate a pure final product, the mixture was used in the next step. Yield:

2.3 g (62 %) calculated based on pure product. ^{1}H NMR (200 MHz; $CDCl_3$; δ, ppm; J, Hz): 1.30 and 1.35 s (9H, t-Bu); 2.37 s (3H, H_3CC=N); 6.55 s (1H, (6')H); 7.09 d (1H, (4')H, ^{3}J=8.3); 7.28-7.37 m (2H, (3')H and (5)H); 7.76 t (1H, (4)H, J=7.6); 8.34 d (1H, (3)H, J=7.8); 8.66 d (1H, (6)H, J=3.8).

Equimolar amounts of 3,6-di-*tert*-butylquinone (1.142 g, 5.2 mmol), 2-(N-(2,5-di-*tert*-butylphenyl)-1-iminoethyl)-pyridine (2.15 g, 5.2 mmol) and nickel tetracarbonyl (0.888 g, 5.2 mmol) were combined in a frozen evacuated ampoule. THF (~150 mL) was condensed in the ampoule. The mixture was carefully warmed. Gas (CO) evolution was observed. The ampoule was periodically frozen and evacuated to remove evolved CO gas. After there was no longer any evolution of CO, the solvent was removed. The remaining residue was recrystallized from ether giving 2.2 g of the dark blue colored product (72% yield). ^{1}H NMR (δ, ppm): 0.91, 1.29, 1.45 and 1.61 all s (9H, $C(CH_3)_3$); 1.21 t (6H, $O(CH_2C\underline{H}_3)_2$, J=7.0); 2.01 s (3H, H_3CC=N); 3.48 q (4H, $O(C\underline{H}_2Me)_2$, J=7.0 Hz); 6.18 m (2H, $O_2C_6H_2$(t-Bu)$_2$, J= 8.2 Hz); 6.99 d (1H, (6')H, ^{4}J=2.0); 7.31 d,d (1H, (4')H, ^{3}J=8.5, ^{4}J=2.0); 7.41 d (1H, (3')H, ^{3}J=8.5); 7.53 – 7.64 m (2H, (3 and 5)H); 7.96 t (1H, (4)H, ^{3}J=7.8); 9.11 d (1H, (6)H, $^3J_{5,6}$=5.4). ^{13}C NMR DEPT (50 MHz, $CDCl_3$, δ, ppm): 15.3 ($O(CH_2\underline{C}H_3)_2$); 17.8 ($\underline{C}H_3C$=N); 29.7, 29.8, 31.3 and 32.6 (all $C(\underline{C}H_3)_3$); 33.2, 33.7, 34.3 and 35.7 (all $\underline{C}Me_3$); 65.9 (O(CH2CH3)2); 110.6 (CH), 111.3 (CH); 120.7 (CH); 123.5 (CH); 124.3 (CH); 126.5 (CH); 128.1 (CH); 133.1; 133.7; 137.6 (CH); 138.2; 143.7; 149.3; 150.3 (CH); 153.7; 159.4; 160.8; 168.2.

Ni-15 2-(N-(2,6-dimethylphenyl)-1-imino-2-ethyl)-pyridine nickel(II) [3,6-di-tert-butyl-catecholate]

An evacuated ampoule containing 5.3 ml (0.043 mole) 2,6-dimethylaniline and 5.8 ml (excess 20%) 2-acetylpyridine was heated at 150 °C for five hours. After removal of H_2O, a yellow oil was obtained. According to ^{1}H NMR spectrum it contains ~25 % of the initial acetylpyridine. Because we were unable to isolate a pure final product, the mixture was used in the next step. Yield: 2.4 g (25 %) calculated based on pure product. ^{1}H NMR (200 MHz, CDC13, δ, ppm): 2.03 s (6H, CH3); 2.17 s (3H, H3CC=N); 6.89-7.08 m (3H, C6H3); 7.37 d,d,d (1H, (5)H, 3J4,5=7.5 Hz,

3J5,6=5.0, 4J3,5=1.0); 7.79 t,d (1H, (4)H, 3J=7.8, 4J4,6=1.8); 8.37 d (1H, (3)H, 3J3,4=8.0 Hz); 8.67 d,m (1H, (6)H, 3J5,6=4.8 Hz).

Equimolar amounts of 3,6-di-*tert*-butylquinone (0.995 g, 4.5 mmol), 2-(N-(2,6-dimethylphenyl)-1-iminoethyl)-pyridine (1.01 g, 4.5 mmol) and nickel tetracarbonyl (0.773 g, 4.5 mmol) were combined in a frozen evacuated ampoule. THF (~150 mL) was condensed in the ampoule. The mixture was carefully warmed. Gas (CO) evolution was observed. The ampoule was periodically frozen and evacuated to remove evolved CO gas. After there was no longer any evolution of CO, the solvent was removed. The remaining residue was recrystallized from CH_2Cl_2/n-hexane (1/2) using slow evaporation to give 1.56 g of the dark blue colored product (69% yield). ^1H NMR (200 MHz, $CDCl_3$, δ, ppm): 0.86 and 1.45 both s (9H, $C(CH_3)_3$); 1.94 s (3H, $H_3C=N$); 2.43 s (6H, $Ar(CH_3)_2$); 6.19 m (2H, $O_2C_6\underline{H}_2(Bu^t)_2$, ^3J=8.4 Hz); 7.05-7.20 m (3H, (3',4' and 5')H); 7.53 d (1H, (3)H, $^3J_{3,4}$=7.8 Hz); 7.62 t (1H, (5)H, ^3J=6.6 Hz); 7.96 t (1H, (4)H, ^3J=7.5 Hz); 9.13 d (1H, (6)H, $^3J_{5,6}$=5.3 Hz).

Co-1 N,N'-(2,6-pyridinediyldiethylidyne)bis[2,4,6-trimethylbenzenamine] cobalt(I) [3,5-di-tert-butyl catecholate]

2,6-bis[1-(2,4,6-trimethylphenylimino)ethyl]pyridine (0.5 g, 1.26 mmol) was dissolved in 50 mL of toluene and chilled to approximately –30 °C. To the chilled solution, 3,5-di-tert-butylcatechol (0.247 g, 1.26 mmol) was added. After stirring for 20 minutes, dicobalt octacarbonyl (0.215 g, 1.26 meq) was added. The resulting solution was allowed to stir at ambient temperature overnight. On the following day, the solution was heated at 40-50 °C for approximately 3 hours and then allowed to stir overnight at ambient temperature. This step was repeated a second day, after which the solvents were removed via vacuum, and approximately 100 mL of pentane was added. The solids were separated from the solution by decanting off the solution and filtering the resulting decanted solution. The pentane solution was reduced in volume and placed in the freezer at approximately –30 °C to induce crystallization. After filtration, 0.119 g of the purple product was collected. The filtrate was again reduced in volume and placed in the freezer. This step was repeated twice to yield an additional 0.090 and 0.012 g of product, respectively, for a total yield of 0.221 g.

Co-2 N,N'-(2,6-pyridinediyldiethylidyne)bis[2-methylbenzenamine] cobalt(I) [3,5-di-tert-butyl catecholate]

2,6-bis[1-(2-methylphenylimino)ethyl]pyridine (1.0 g, 2.93 mmol) was dissolved in 100 mL of toluene and was placed in a freezer at –30 °C for one hour to chill the solution. To the chilled solution, 3,5-di-tert-butylcatechol (0.575 g, 2.93 mmol) was added. After stirring for 5 minutes, dicobalt octacarbonyl (0.500 g, 2.93 meq) was added. The resulting solution was allowed to stir at ambient temperature for approximately two and a half days. The reaction flask was then placed in the freezer at –30 °C for 30 minutes to chill the reaction mixture. Afterwards, the contents were filtered, and the filtrate was reduced in volume and placed in the freezer at –30 °C. After several days, no crystals formed, so the solvent (toluene) was completely removed via vacuum and 10 mL of pentane was added. Again the flask was stored for several days at –30 °C. The contents of the flask were then filtered and washed with cold pentane. A yellow solid with flecks of green remained on the filter. Room temperature pentane was then used to wash the product into a fresh collection flask. The darker solid remained on the frit and a yellow solution was collected. The filtrate was placed in the freezer at –30 °C, and a few days later was filtered, leaving behind a yellow solid that was washed with cold pentane and dried. A yellow solid (0.367 g) was isolated. The remaining filtrate was reduced in volume and placed back in the freezer. Repeating the filtration and washing step, an additional 0.115 g of product, for a total yield of 0.482 g.

Experimental – Preparation of Supported Pre-catalysts

S-1 Supported [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate].

In a 50 mL round bottom flask with stir bar, 30 mg of [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate] and about 3 mL of toluene were added. To the solution, 3.0 g of 800 °C calcined 948 Davison silica was added. Approximately, an additional 10 mL of toluene was added to aid stirring. The mixture was stirred for two hours, after which time the volatiles

were removed via vacuum. After all visible solvent was removed, the support material was set aside overnight. The following morning, the remaining volatiles were removed yielding 2.80 g of a pale green solid. Based on the yield, the loading level was calculated to be 16.3 μmol Ni-1/g silica.

S-2 Supported [1,4-bis-(2,6-di-isopropylphenyl)-1,4-diaza-1,3-butadiene] nickel(II) [3,6-di-*tert*-butylcatecholate].

The procedure for S-1 was followed except that the volatiles were removed by pumping on the flask overnight. A pale green solid was isolated (2.75 g). Based on the yield, the loading level was calculated to be 16.6 μmol Ni-1/g silica.

Experimental – Polymerizations

All pre-catalysts were used as toluene solutions unless otherwise mentioned. Solutions were prepared in a dry box containing an inert atmosphere. Anhydrous toluene (99.8% packaged under nitrogen in Sure/Seal™ bottles) used for pre-catalyst solutions or slurries was purchased from Aldrich Chemical Company and stored in the dry box over 4A mole sieves. Alternatively, the toluene used for preparing the pre-catalyst solution or slurries was the same as the toluene used as the reactor solvent. Additives, 2,5-di-*tert*-butyl-1,4-benzoquinone, 3,3',5,5'-tetra-*tert*-butyldiphenylquinone, and 1,4-benzoquinone were purchased from Aldrich Chemical Company.

TMA (trimethyl aluminum, NEAT) was purchased from Akzo Nobel or Aldrich Chemical Company. Tris(perfluorphenyl) boron (A1, $B(pfp)_3$, $B(C_6F_5)_3$) was purchased from Boulder Scientific Company or Strem Chemical Company. Dimethylanilinium tetrakis(perfluorophenyl)borate (A2, [DMAH][$B(pfp)_4$], [$PhNMe_2H$][$B(C_6F_5)_4$]) was purchased from Albemarle Corporation or Boulder Scientific Company. MAO (methylalumoxane, 10 wt% in toluene) was purchased from Albemarle Corporation. MAO (methylalumoxane, 30 wt% in toluene) was purchased from Albemarle Corporation and stored at –40 °C. MMAO (modified

methylaluminoxane, 7 wt% in heptene) was obtained from Akzo Nobel and has 25% of its methyl groups replaced with isobutyl groups.

For experiments 1-109, 390-396, and C1 to C19, polymerization grade ethylene was used and further purified by passing it through two series of 500 cc Oxyclear cylinders from Labclear (Oakland, CA) followed by a 500 cc column packed with aluminum oxide, Brockman I, from Aldrich Chemical Company. For experiments 110-389 and C20-C48, polymerization grade ethylene was used and further purified by passing it through series of columns: a 500 cc Oxyclear cylinder, followed by a 500 cc column packed with 3A mole sieves (Aldrich) and a 500 cc column packed with 5A mole sieves (Aldrich). For experiments 397-419 and C49-C53, ethylene was obtained from BOC (Scientific Grade 4.5, 99.995% purity) and used without further purification. For experiments using propylene, polymerization grade propylene was used and further purified by passing it through two 500 cc Oxyclear cylinders in series followed by a 500 cc column packed with aluminum oxide (Brockman I), and a 500 cc column of dried 13X mole sieves. For experiments using 1-hexene, the 1-hexene (from Alfa Aesar) was sparged with nitrogen to remove air and stored over 4A mole sieves. Comonomers, cyclopentene (cP), cyclohexene (cH), and norbornene (NB) were purchased from Aldrich Chemical Company and were distilled from CaH_2 and degassed prior to use.

The reactor solvent for experiments 1-396, and C1 to C48, was high purity, dry and deoxygenated toluene (from ExxonMobil Chemical) stored under nitrogen gas and used as supplied. The reactor solvent for experiments 397-426 and C49-C56, was toluene obtained from Aldrich Chemical Company as anhydrous grade in 18 L Pure-Pac™ containers and further dried by sequential passage through columns of A-2 activated alumina (LaRoche, 8 x 14 mesh) and Q-5 copper reactant (copper oxide on alumina, Engelhard CU-0226S, 14 x 20 mesh). For additional information on drying solvents, see A. B. Pangborn, M. A. Giardello, R. H. Grubbs, R. K. Rosen, F. J. Timmers, *Organometallics* **1996**, 15, 1518.

For experiments 1-109, 390-396 and C1-C19, polymerizations were conducted in a 1 L stainless steel Zipperclave reactor equipped with a paddle stirrer, a temperature controller, an on-demand supply of ethylene regulated to maintain a constant reactor pressure, and a supply of dry high pressure nitrogen to maintain an

inert atmosphere. Monomer and solvent, directly plumbed into the reactor, were passed through drying columns prior to entering the reactor unless indicated otherwise.

A typical polyethylene reaction (examples 1-89 and C1-C14) began by adding 400 mL of dry toluene and the indicated amount of 10 wt% methylalumoxane in toluene to the reactor vessel. Afterwards, the reactor was vented to reduce excess nitrogen pressure. The reactor was brought to the desired temperature, and the catalyst precursor, typically dissolved in dry toluene and contained in a catalyst addition tube, was flushed into the reactor using the desired ethylene differential pressure. The reaction was run for 15 minutes during which time ethylene was added semi-continuously as needed to maintain reactor pressure. After the 15 minute time period, the ethylene flow was discontinued. The reactor was quickly cooled and vented. The reactor contents were precipitated in methanol. The polymer was initially dried under a flow of air and then typically dried overnight in a vacuum oven at 90-100 °C. The results of these polymerizations are summarized in Tables 1-6.

By way of example, a polypropylene reaction (examples 90-100) began by adding 250 mL of dry toluene and 10 wt% methylalumoxane in toluene to the reactor. The reactor was vented to reduce excess nitrogen pressure. Afterwards, 250 mL of propylene was added to the reactor and the reactor was heated to the desired reaction temperature. The catalyst precursor, dissolved in dry toluene contained in a catalyst addition tube, was flushed into the reactor using approximately 20 mL of dry toluene under nitrogen pressure. The reaction was run for 30 minutes at which time the reactor was quickly cooled and vented. The reactor contents were precipitated in methanol. The polymer was initially dried under a flow of air and then typically dried overnight in a vacuum oven at 90-100 °C. The results of these polymerizations are summarized in Table 7.

By way of example, an ethylene/propylene copolymerization reaction (examples 101-104) began by adding 200 mL of dry hexane and 10 wt% methylalumoxane in toluene to the reactor. The reactor was vented to reduce excess nitrogen pressure. Afterwards, 300 mL of propylene was added to the reactor and the reactor was heated to the desired reaction temperature. The catalyst precursor,

dissolved in dry toluene contained in a catalyst addition tube, was flushed into the reactor using the desired ethylene differential pressure. The reaction was run for 15 minutes at which time the reactor was quickly cooled and vented. The reactor contents were precipitated in methanol. The polymer was initially dried under a flow of air and then typically dried overnight in a vacuum oven at 90-100 °C. The results of these polymerizations are summarized in Tables 8 and 9.

By way of example, an ethylene/1-hexene copolymerization reaction (examples 105-109) began by adding 350 mL of dry toluene and 10 wt% methylalumoxane in toluene to the reactor. The reactor was vented to reduce excess nitrogen pressure. Afterwards, 50 mL of 1-hexene was cannulated into the reactor, and the reactor was heated to the desired reaction temperature. The catalyst precursor, dissolved in dry toluene contained in a catalyst addition tube, was flushed into the reactor using the desired ethylene differential pressure. The reaction was run for 15 minutes at which time the reactor was quickly cooled and vented. The reactor contents were precipitated in methanol. The polymer was initially dried under a flow of air and then typically dried overnight in a vacuum oven at 90-100 °C. The results of these polymerizations are summarized in Tables 8 and 9.

By way of example, a supported polymerization reaction (examples 390-396) began by adding 400 mL of dry toluene and 10 wt% methylalumoxane in toluene to the reactor. The reactor was vented to reduce excess nitrogen pressure. Afterwards, the reactor was heated to 40 °C. The supported catalyst precursor contained in a catalyst addition tube, was flushed into the reactor using the desired ethylene differential pressure of 6.8 atmospheres. The reaction was run for the time indicated, after which time the reactor was quickly cooled and vented. The reactor contents were precipitated in methanol. The polymer was initially dried under a flow of air and then typically dried overnight in a vacuum oven at 90-100 °C. The results of these polymerizations are summarized in Tables 13 and 14.

By way of example, small scale polymerizations (examples 110-389 and C20-C48) were conducted in an inert atmosphere (N_2) drybox using autoclaves lined with glass test tubes (internal volume of reactor = 23.5 mL) and equipped with disposable PEEK paddle stirrers (800 rpm). The autoclaves were prepared by purging with dry

nitrogen at 110°C for 5 hours and then at 25°C for 5 hours. The diluent, comonomer, activator and co-activator (if used), were added via syringe at room temperature and atmospheric pressure. The reactor was then brought to process pressure and charged with ethylene while stirring at 800 RPM. The pre-catalyst (TMC) was added via syringe with the reactor at process conditions. In most cases the pre-catalyst was added as a solution. In some indicated examples, the pre-catalyst was added as a well dispersed slurry. Ethylene was allowed to enter (through the use of computer controlled solenoid valves) the autoclaves during polymerization to maintain reactor gauge pressure (+/- 2 psig). Reactor temperature was monitored and typically maintained within +/- 1°C. Polymerizations were halted by addition of approximately 50 psid O_2/Ar (5 mole% O_2) gas mixture to the autoclaves for approximately 30 seconds. The polymerizations were quenched based on integrated ethylene pressure loss to produce approximately 0.10 to 0.15 grams or for a maximum of 15 minutes. The reactors were cooled and vented. The polymer was isolated after the solvent was removed *in-vacuo*. Yields reported include total weight of polymer and residual catalyst. Amounts of reagents used, process conditions and polymer characterization are reported in Tables 10-12.

For examples 397-403, 406-412, and C50-C51, polymerizations were conducted in a 300 cc Hasteloy C Parr reactor equipped with a paddle stirrer, a temperature controller, an on-demand supply of ethylene regulated to maintain a constant reactor pressure via a Pressure Vessel Tank (PVT, 500 cc volume charged with ~ 1000 psig of ethylene), and a supply of dry high pressure nitrogen to maintain an inert atmosphere. Monomer was directly plumbed into the reactor. An approximate stirring speed of 450 rpm was used.

A typical ethylene polymerization reaction conducted using a 300 cc Hasteloy C Parr reactor (examples 397-403) began by adding 140 mL of dry toluene and 30 wt % MAO to the reactor bottom in the drybox (for example 399, $B(C_6F_5)_3$ (A1) was also added). Separately, in the drybox, the transition metal catalyst was dissolved in 10 mL dry toluene in a scintillation vial and loaded into a 30 cc stainless steel Hoke bomb. The Parr reactor was sealed, removed from the drybox, connected to an ethylene manifold with a 500 cc PVT charged with approximately 1000 psig of

ethylene, heated to 80 °C, stirred using a mechanical stirrer, pressurized with the desired gauge pressure of ethylene for three minutes, and then vented to atmospheric pressure. The Hoke bomb was attached to the injection port on the Parr reactor head and the 10 mL of transition metal catalyst solution was injected using a charge of ethylene equal to the desired gauge pressure. The ethylene pressure was maintained for the duration of the desired time using the PVT tank. Subsequently, the reactor was cooled to room temperature and vented, and the polymerization was quenched by injection of 5 mL MeOH. The contents of the reactor were added to an excess of acidified MeOH (5% v/v HCl) and stirred overnight. The insoluble polymer was collected by filtration, rinsed with additional clean MeOH, and dried in a vacuum oven overnight at 60 °C. The results of these polymerizations are summarized in Tables 15 and 16.

By way of example, an ethylene polymerization reaction conducted in the presence of cyclohexene using a 300 cc Parr reactor (examples 406-412, C50-C51) began by adding 140 mL of dry toluene and 30 wt % MAO to the reactor bottom in the drybox. Separately, in the drybox, the transition metal catalyst was dissolved in 10 mL dry toluene in a scintillation vial and loaded into a 30 cc stainless steel Hoke bomb. The Parr reactor was sealed, removed from the drybox, connected to an ethylene manifold with a 500 cc PVT charged with approximately 1000 psig of ethylene, heated to 80 °C, stirred using a mechanical stirrer, pressurized with the desired gauge pressure of ethylene for three minutes, and then vented to atmospheric pressure. The Hoke bomb was attached to the injection port on the Parr reactor head and the 10 mL of transition metal catalyst solution was injected using a charge of ethylene equal to the desired gauge pressure. The ethylene pressure was maintained for the duration of the desired time using the PVT tank. Subsequently, the reactor was cooled to room temperature and vented, and the polymerization was quenched by injection of 5 mL MeOH. The contents of the reactor were added to an excess of acidified MeOH (5% v/v HCl) and stirred overnight. The insoluble polymer was collected by filtration, rinsed with additional clean MeOH, and dried in a vacuum oven overnight at 60 °C. The results of these polymerizations are summarized in Tables 17 and 18.

For examples 404-405, 413-419, C49, and C52-C53, polymerizations were conducted in a 3 oz. glass Fischer-Porter pressure vessel equipped with an on-demand supply of ethylene regulated to maintain a constant reactor pressure via a PVT (500 cc volume charged with ~ 1000 psig of ethylene), and a supply of dry high pressure nitrogen to maintain an inert atmosphere. Thermostatting was achieved by submersing the bottom of the vessel into an oil bath. Stirring was achieved using magnetic stirring bars.

A typical ethylene polymerization reaction conducted using a 3 oz. glass Fischer-Porter pressure vessel (examples 404-405, C49) began by charging the glass vessel in the drybox with a stirbar, 7 wt % MMAO, and 20 mL dry toluene (25 mL for example C49). The vessel was then sealed. Separately, in the drybox, the transition metal catalyst was dissolved or slurried in 5 mL dry toluene in a scintillation vial and loaded into a 5 mL air-tight syringe. The sealed pressure vessel was removed from the glove box, connected to an ethylene manifold with a 500 cc PVT charged with approximately 1000 psig of ethylene, heated to the desired temperature with magnetic stirring, and pressurized with the desired gauge pressure of ethylene. The vessel was vented to atmospheric pressure and the pressurization procedure repeated twice to ensure flushout of residual argon from the vessel. The transition metal catalyst solution was then injected into the vessel using the syringe port on the vessel head, and the vessel was then pressurized to the desired gauge pressure of ethylene and allowed to stir for the desired length of time. Subsequently, the vessel was vented and the polymerization was quenched with a small amount (1-5 mL) of 5 % by volume acidified methanol. The contents of the vessel were added to an excess of clean methanol and the precipitated polymer was collected by filtration, rinsed with additional methanol, and dried in a vacuum oven at 60 °C overnight. The results of these polymerizations are summarized in Tables 15 and 16.

By way of example, an ethylene polymerization conducted in the presence of cyclohexene using a 3 oz. glass Fischer-Porter pressure vessel (example 413) began by charging the glass vessel in the drybox with a stirbar, 30 wt % MAO, cyclohexene, and 20 mL dry toluene. The vessel was then sealed. Separately, in the drybox, the transition metal catalyst was dissolved in 5 mL dry toluene in a scintillation vial and loaded into a 5 mL air-tight syringe. The sealed pressure vessel was removed from

the glove box, connected to an ethylene manifold with a 500 cc PVT charged with approximately 1000 psig of ethylene, heated to the desired temperature with magnetic stirring, and pressurized with the desired gauge pressure of ethylene. The vessel was vented to atmospheric pressure and the pressurization procedure repeated twice to ensure flush out of residual argon from the vessel. The transition metal catalyst solution was then injected into the vessel using the syringe port on the vessel head, and the vessel was then pressurized to the desired gauge pressure of ethylene and allowed to stir for the desired length of time. Subsequently, the vessel was vented and the polymerization was quenched with a small amount (1-5 mL) of 5 % by volume acidified methanol. The contents of the vessel were added to an excess of clean methanol and the precipitated polymer was collected by filtration, rinsed with additional methanol, and dried in a vacuum oven at 60 °C overnight. The results of this polymerization are summarized in Tables 17 and 18.

By way of example, an ethylene / cyclopentene copolymerization conducted using a 3 oz. glass Fischer-Porter pressure vessel (examples 414-419 and C52-C53) began by charging the glass vessel in the drybox with a stirbar, 30 wt % MAO or TMA / $B(C_6F_5)_3$ (A1), cyclopentene, and 20 mL dry toluene, TMA is trimethyl aluminum. The vessel was then sealed. Separately, in the drybox, the transition metal catalyst was dissolved or slurried in 5 mL dry toluene in a scintillation vial and loaded into a 5 mL air-tight syringe. The sealed pressure vessel was removed from the glove box, connected to an ethylene manifold with a 500 cc PVT charged with approximately 1000 psig of ethylene, heated to the desired temperature with magnetic stirring, and pressurized with the desired gauge pressure of ethylene. The vessel was vented to atmospheric pressure and the pressurization procedure repeated twice to ensure flush out of residual argon from the vessel. The transition metal catalyst solution was then injected into the vessel using the syringe port on the vessel head, and the vessel was then pressurized to the desired gauge pressure of ethylene and allowed to stir for the desired length of time. Subsequently, the vessel was vented and the polymerization was quenched with a small amount (1-5 mL) of 5 % by volume acidified methanol. The contents of the vessel were added to an excess of clean methanol and the precipitated polymer was collected by filtration, rinsed with

additional methanol, and dried in a vacuum oven at 60 °C overnight. The results of these polymerizations are summarized in Tables 19 and 20.

For examples 420-426 and C54-C56, polymerizations were conducted in capped 20 mL glass scintillation vials in a drybox under an argon atmosphere. No temperature control was employed. Stirring was achieved using magnetic stirring bars.

A typical norbornene polymerization began by charging a 20 mL glass scintillation vial with the transition metal catalyst, a stirbar, and 2 mL (examples 420, 422, C54) or 2.5 mL (examples 421, 423-426, C55-C56) dry toluene in the drybox. In a separate vial, norbornene was weighed out. For examples 420, 422, and C54, 30 wt % MAO was then added directly to the neat norbornene, and this mixture was added to the transition metal catalyst solution after mixing. An additional 1 mL of toluene was used to rinse out the vial containing the 30 wt % MAO / norbornene and this rinse was then also added to the transition metal catalyst solution. For Examples 421, 423-424, and C55, the norbornene was diluted with 2.5 mL toluene and added to the transition metal catalyst solution, which was then further diluted with another 2 mL toluene. The 30 wt % MAO was then quickly weighed directly into the transition metal catalyst / norbornene solution. For Examples 425, 426, and C66, $B(C_6F_5)_3$ (A1) and trimethyl aluminum (TMA) were added to the norbornene along with 5 mL toluene. This mixture was then added to the transition metal catalyst solution. In each case, the vial containing the transition metal catalyst, activator, and norbornene was then capped and allowed to stir for the desired length of time at room temperature in the drybox, after which it was removed from the drybox and quenched with 50 mL of 50 : 1 v/v MeOH : HCl. After stirring the solids for 2 – 3 hours in excess clean methanol, the insoluble polymer was collected by filtration, rinsed with clean MeOH, and dried in a vacuum oven overnight at 60-75 °C. The results of these polymerizations are summarized in Tables 21 and 22.

For examples 1-109, C2-14, and 390-396, molecular weights (weight average molecular weight (Mw) and number average molecular weight (Mn)) were measured by Gel Permeation Chromatography using a Waters 150C Gel Permeation Chromatograph equipped with a differential refractive index detector and calibrated

using polystyrene standards. BHT (2,6-di-*tert*-butyl-4-methylphenol) stabilized samples were run in 1,2,4-trichlorobenzene (145 °C) using three PLgel Mixed-B 10 μm (Polymer Laboratories) columns in series. No column spreading corrections were employed, but data on generally accepted standards, e.g. National Bureau of Standards Polyethylene 1475, demonstrated a precision with 0.1 units for Mw/Mn, which was calculated from elution times. For examples 397-426 and C49-C56, molecular weights were measured on a Waters Associates 150C High Temperature Gel Permeation Chromatograph equipped with a differential refractive index detector. BHT stabilized samples were run in 1,2,4-trichlorobenzene (135 °C) using three Polymer Laboratories mixed bed Type B columns at a 1.0 mL / min solvent flow rate. For examples 110-389 and C20-C48, molecular weights were measured by Gel Permeation Chromatography using a Symyx Technology GPC equipped with evaporative light scattering detector and calibrated using polystyrene standards (Polymer Laboratories: Polystyrene Calibration Kit S-M-10: Mp (peak Mw) between 5000 and 3,390,000). BHT stabilized samples were run in 1,2,4-trichlorobenzene at 135°C sample temperature (160°C oven/columns) using three Polymer Laboratories: PLgel 10μm Mixed-B 300 x 7.5mm columns in series. No column spreading corrections were employed. Numerical analyses were performed using Epoch® software available from Symyx Technologies.

For examples 1-109, C2-C14, and 390-396 polymer comonomer incorporation, branching and or end-group analysis was determined by ^{1}H NMR using a Varian Unity+ 400 MHz instrument run with a single 30° flip angle, RF pulse. 120 pulses with a delay of 8 seconds between pulses were signal averaged. The polymer sample was dissolved in heated tetrachloroethane-d^2 and signal collection took place at 120 °C. For examples 37-42, 46-49, and 51-52, ^{13}C NMR spectra were obtained using a 90 degree pulse angle, at least a 14 second delay between successive pulses, sweep width of 6900 Hz, with full broadband proton noise decoupling. Samples were dissolved at approximately 15% by weight in tetrachloroethane-d_2 and spectra were obtained at 125°C. For examples 397 – 419 and C53, polymer comonomer incorporation, end-group analysis, and / or branching was determined by ^{1}H or ^{13}C NMR (as indicated), with $Cr(acac)_3$ used as a relaxation agent for ^{13}C NMR spectra where noted (acac is acetylacetonate). The polymer sample was dissolved in heated 1,2-dichlorobenzene-d_4 or 1,1,2,2-tetrachloroethane-d_2 and signal collection took

place at 120 °C. A Varian Unity+ 500 MHz instrument with a 10 mm broadband or 5 mm switchable probe, or a Varian Inova 300 spectrometer with a 10 mm broadband probe, was used. Analysis of the ^{13}C NMR spectra for Examples 37-42, 46-49, and 51-52 was as follows. Methyl branching (C_1) in the polymer was measured as the number of methyl branches per 1000 carbon atoms using the average branch intensity determined from the CH resonance at 33.2 ppm, the CH_3 resonance at 20.1 ppm, and the backbone CH_2 resonance that was next to the CH resonance at 37.6 ppm. Ethyl branching (C_2) in the polymer was measured as the number of ethyl branches per 1000 carbon atoms via using the average branch intensity determined from CH resonance at 39.4 ppm, the CH_2 resonance next to the CH resonance at 34.1 ppm, and when necessary the CH_3 resonance at 11.3 ppm. Propyl branching (C_3) in the polymer was measured as the number of propyl branches or chain ends per 1000 carbon atoms using the average branch intensity determined from the CH resonance at 37.9 ppm, the CH_3 resonance at 14.5 ppm, and the branch CH_2 signal at 20.4 ppm. Butyl and longer branching (C_4^+) in the polymer was measured as the number of butyl and longer branches per 1000 carbon atoms using the branch CH resonance at 38.2 ppm. ^{13}C NMR analysis for Examples 399, 406-417. 419 and C50-C51 was as follows. Methyl branching (C_1) in the polymer was measured as the number of methyl branches per 1000 carbon atoms using the branch CH resonance at 33.2 ppm or the CH_3 resonance at 20.1 ppm. Ethyl branching (C_2) in the polymer was measured as the number of ethyl branches per 1000 carbon atoms using the branch CH resonance at 39.4 ppm or the CH_3 resonance at 11.3 ppm. Propyl branching (C_3) in the polymer was measured as the number of propyl branches or chain ends per 1000 carbon atoms using the branch CH_3 resonance at 14.5 ppm and optionally the CH_2 resonance at 20.4 ppm. Butyl and longer branching in the polymer was measured as the number of butyl and longer branches (C_4^+) or chain ends per 1000 carbon atoms using the branch CH resonance at 38.2 ppm. "33.5 ppm CH units" was the number of CH units in the polymer per 1000 carbon atoms representing an additional, unidentified branch with a ^{13}C NMR methine resonance at 33.5 ppm. End-group analysis for examples reporting these numbers were measured by ^1H NMR and were analyzed as follows. Vinylenes were measured as the number of vinylenes per 1000 carbon atoms using the resonances between 5.5-5.31 ppm. Trisubstituted end-groups ("trisubs") were measured as the number of trisubstituted groups per 1000 carbon

atoms using the resonances between 5.3-4.85 ppm, by difference from vinyls. Vinyl end-groups were measured as the number of vinyls per 1000 carbon atoms using the resonances between 5.9-5.65 and between 5.3-4.85 ppm. Vinylidene end-groups were measured as the number of vinylidenes per 1000 carbon atoms using the resonances between 4.85-4.65 ppm. Total olefins are the sum total of vinylene, trisubs, vinyl, and vinylidene structures measured as the number of olefins per 1000 carbon atoms via ^1H NMR. In some cases, vinylenes, trisubs, and vinyls are also tabulated as ratios of mole percentages of structures summing to 100%. Cyclopentene incorporated into the polymer was measured as a mole percentage of total olefinic monomer units incorporated via ^{13}C NMR, using the 2-*eme* (41.22 ppm), 1,3-*eme* (40.67 ppm), α-*cee* (37.06 ppm), and optionally the 4,5-*eme* (32.22 ppm) peaks (Jerschow, A.; Ernst, E.; Hermann, W.; Müller, N. *Macromolecules* **1995**, *28*, 7095).

For examples 397-419 and C49-C52, DSC data were obtained on a TA Instruments 2920 calorimeter using a scan rate of 10 degrees per minute. Reported Tm (°C, melt transition) values are maxima of second heats.

For examples 110-389 and C20-C48, the sample preparation for SAMMS (Sensory Array Modular Measurement System) thermal analysis measurements involved depositing the BHT stabilized polymer solution onto a silanized wafer (Part Number S10457, Symyx). The solvent was then evaporated off at ~145°C. By this method, approximately between 0.12 and 0.24 mg of polymer was deposited onto each corresponding wafer cell. Thermal analysis was measured on a Symyx Technologies SAMMS instrument that measures polymer melt temperatures via the 3 ω technique. The analysis first employs a rapid-scan protocol that heats each cell from 27°C to 200°C in ~35 seconds and then rapidly cools the sample to room temperature. This complete procedure takes approximately 60 seconds per cell and was used to minimize each sample's thermal history. The second step involves running a high-resolution scan protocol to measure the second melt of the sample. The protocol heats each cell from 27°C to 200°C in ~3 minutes and then rapidly cools the sample to room temperature. The high-resolution scan takes approximately three times the amount of time to complete as the rapid-scan protocol. If multiple melting peaks are present, Epoch® Software reports the largest amplitude peak. The results are reported in the tables as Tm (°C).

The results of the polymerization experiments are tabulated below. In the following Tables, TMC refers to the identity of the transition metal compound (pre-catalyst = catalyst precursor) used. Al/M was the molar aluminum to transition metal ratio used. T was the reactor temperature in Celsius (°C) and was controlled within a few degrees of the set temperature (unless indicated otherwise). C_2H_2 was the differential pressure of ethylene (unless indicated otherwise) in atmospheres that was semi-continuously fed to the reactor. Polymer (g or mg) was the weight of polymer produced. In some cases, residual ash was also present and contributes to this weight. Activity was the catalyst activity measured as kg of polymer per mole of transition metal compound per atmosphere of ethylene per hour (kg P/ mol TMC•atm•hr) for reactions using ethylene, and as kg of polymer per mole of transition metal compound per hour (kg P/ mol TMC•hr) for reactions not using ethylene. Mw was weight average molecular weight of the polymer as measured by GPC. Mn was the number average molecular weight of the polymer as measured by GPC. MWD was Mw/Mn. Branching was the amount of short chain branching and long chain branching in the polymer as measured by ^1H NMR. It was reported as the number of branches per 1000 carbon atoms and was not corrected for chain end-groups. C_1, C_2, C_3, C_4^+ was respectively, the methyl, ethyl, propyl and butyl and greater branching in the polymer measured as the number of respective branches per 1000 carbon atoms via ^{13}C NMR. "33.5 ppm CH units" was the number of CH units in the polymer per 1000 carbon atoms representing an additional, unidentified branch with a ^{13}C NMR methine resonance at 33.5 ppm. Vinylenes, trisubs, vinyls, and vinylidenes are respectively, the number of vinylene end-groups, trisubstituted end-groups, vinyl end-groups and vinylidene end-groups measured as the number of the respective end-groups per 1000 carbon atoms via ^1H NMR. In some cases, vinylenes, trisubs, vinyls and vinylidenes are also tabulated as ratios of mole percentages of structures summing to 100%. Mol % cyclopentene was the amount of cyclopentene incorporated into the polymer measured as a mole percentage of total olefinic monomer units incorporated via ^{13}C NMR. Entries in the tables preceded by a "C#" are comparative examples.

Table 1: Ethylene polymerization examples (Ni-1, Ni-2, Ni-3, Ni-Br) – Part A

Run #	TMC	TMC[1] (μmol)	10 wt% MAO (ml)	Al/M (molar)	T (°C)	C_2H_4 (atm)	Polymer (g)	Activity
1	Ni-1	1.53	1.9	1246	80	4.42	0.8	468
2	Ni-1	1.98	2.5	1261	80	4.42	1.0	456
3	Ni-1	3.97	5	1261	80	4.42	1.9	433
4	Ni-1	3.97	5	1261	80	4.42	1.4	315
5	Ni-1	3.97	5	1261	60	3.54	9.5	2,697
6	Ni-1	3. 97	5	1261	60	3.54	10.6	3,031
7	Ni-1	3. 97	5	1261	40	2.72	7.4	2,747
8	Ni-1	1.98	2.5	1261	40	2.72	16.9	12,528
9	Ni-1	1.98	2.5	1261	40	2.72	18.2	13,507
10	Ni-1	1.98	2.5	1261	40	2.72	11.8	8,755
11	Ni-1	1.98	2.5	1261	40	2.72	18.2	13,507
12	Ni-1	1.98	2.5	1261	40	4.08	27.9	13,798
13	Ni-1	1.98	2.5	1261	40	4.08	27.2	13,442
14	Ni-1	1.07	1.3	1218	40	6.80	21.8	12,005
15	Ni-1	1.07	1.3	1218	40	6.80	23.1	12,704
16	Ni-2	4.00	5	1249	80	4.42	2.2	499
17	Ni-2	4.00	5	1249	80	4.42	2.2	499
18	Ni-2	4.00	5	1249	80	4.42	2.3	529
19	Ni-2	4.00	5	1249	60	3.54	8.3	2,350
20	Ni-2	4.00	5	1249	60	3.54	8.6	2,415
21	Ni-2	1.93	2.5	1294	40	2.72	20.3	15,465
22	Ni-2	1.93	2.5	1294	40	2.72	21.3	16,218
23	Ni-3	4.05	5	1234	80	4.42	1.9	429
24	Ni-3	4.05	5	1234	80	4.42	1.9	431
25	Ni-3	4.05	5	1234	60	3.54	9.2	2,573
26	Ni-3	4.05	5	1234	60	3.54	11.7	3,262
27	Ni-3	1.96	2.5	1278	40	2.72	20.5	15,404
28	Ni-3	1.96	2.5	1278	40	2.72	20.8	15,659
C1	Ni-Br	1.34	1.7	1265	80	4.42	1.2	834
C2	Ni-Br	2.69	3.4	1265	80	4.42	2.2	754
C3	Ni-Br	2.69	3.4	1265	80	4.42	1.2	397
C4	Ni-Br	2.69	3.4	1265	60	3.54	10.5	4,433
C5	Ni-Br	2.69	3.4	1265	60	3.54	7.6	3,180
C6	Ni-Br	1.34	1.7	1265	40	2.72	3.2	3,445
C7	Ni-Br	1.34	1.7	1265	40	2.72	5.1	5,555

1. TMC was used as a toluene solution (10-15 mg of TMC per 10 ml of dried toluene) with the exception of NiBr that was added as a toluene slurry because of its poor solubility in toluene.

Table 2: Ethylene polymerization examples (Ni-1, Ni-2, Ni-3, Ni-Br) – Part B

Run #	Mw	Mn	MWD	Branching	Vinylenes	Trisubs	Vinyls	Vinylidenes
1	44,476	20,515	2.17	48.7	-	-	-	-
2	36,367	10,595	3.43	100.6	-	-	-	-

3	24,661	10,043	2.46	51.2	0.68	0.01	0.63	0.05
4	26,565	10,547	2.52	52.6	0.55	0.00	0.55	0.11
5	78,175	26,136	2.99	30.4	0.14	0.01	0.33	0.06
6	82,051	27,549	2.98	31.5	0.41	0.00	0.62	0.08
7	87,552	26,881	3.26	-	0.15	0.00	0.27	0.01
8	128,383	40,744	3.15	11.9	0.06	0.04	0.36	0.03
9	126,189	42,484	2.97	12.3	0.04	0.00	0.29	0.00
10	155,842	38,849	4.01	8.8	0.07	0.09	0.24	0.00
11	126,405	37,202	3.40	9.9	0.04	0.01	0.22	0.00
12	125,497	39,657	3.16	7.0	0.07	0.03	0.22	0.01
13	121,909	40,917	2.98	7.5	0.03	0.01	0.23	0.01
14	110,715	39,809	2.78	4.2	0.04	0.03	0.26	0.01
15	121,356	42,104	2.88	4.3	0.03	0.04	0.25	0.02
16	29,739	11,433	2.60	59.8	0.44	0.00	0.46	0.08
17	38,998	16,310	2.39	58.6	0.51	0.01	0.50	0.05
18	176,641	14,947	11.82	52.0	0.36	0.00	0.40	0.07
19	94,798	27,012	3.51	46.9	0.42	0.00	0.64	0.04
20	82,891	24,447	3.39	37.6	0.21	0.00	0.31	0.04
21	122,154	44,401	2.75	16.7	0.06	0.02	0.28	0.01
22	125,810	37,279	3.37	29.7	0.08	0.02	0.29	0.01
23	40,150	17,592	2.28	44.9	0.44	0.01	0.42	0.05
24	62,180	15,706	3.96	43.5	0.45	0.00	0.41	0.03
25	75,871	24,424	3.11	32.5	0.22	0.04	0.37	0.03
26	89,053	25,915	3.44	28.7	0.18	0.00	0.30	0.04
27	117,747	40,699	2.89	13.7	0.06	0.00	0.30	0.01
28	115,762	37,892	3.06	13.0	0.05	0.01	0.29	0.01
C1	-	-	-	-	-	-	-	-
C2	27,282	13,763	1.98	52.9	0.49	0.00	0.45	0.00
C3	32,905	12,655	2.60	53.1	0.49	0.00	0.44	0.00
C4	53,660	21,914	2.45	31.8	0.21	0.00	0.34	0.00
C5	56,799	23,758	2.39	31.3	0.21	0.01	0.35	0.01
C6	122,362	38,891	3.15	10.5	0.04	0.00	0.26	0.00
C7	114,397	38,664	2.96	10.6	0.05	0.00	0.27	0.00

Table 3: Ethylene polymerization examples (Ni-6, Ni-8, Ni-9, Ni-10, Ni-11) – Part A

Run #	TMC	TMC[1] (μmol)	10 wt% MAO (ml)	Al/M (molar)	T (°C)	C_2H_4 (atm)	Polymer (g)	Activity
29	Ni-6	2.02	2.5	1235	40	2.72	8.4	6,100
30	Ni-6	2.02	2.5	1235	40	2.72	8.1	5,867
31	Ni-6	2.02	2.5	1235	40	4.08	11.4	5,509
32	Ni-6	2.02	2.5	1235	40	4.08	9.3	4,502
33	Ni-6	2.02	2.5	1235	40	6.80	16.4	4,758
34	Ni-6	2.02	2.5	1235	40	6.80	16.1	4,662
35	Ni-8	1.97	2.5	1267	60	4.08	5.8	2,900
36	Ni-8	1.97	2.5	1267	60	4.08	6.9	3,412
37	Ni-8	1.97	2.5	1267	40	2.72	12.6	9,348

38	Ni-8	1.97	2.5	1267	40	2.72	12.4	9,214
39	Ni-8	1.97	2.5	1267	40	4.08	17.8	8,849
40	Ni-8	1.97	2.5	1267	40	4.08	18.0	8,919
41	Ni-8	1.97	2.5	1267	40	6.80	21.6	6,433
42	Ni-8	1.97	2.5	1267	40	6.80	26.1	7,780
43	Ni-9	2.00	2.5	1249	60	2.72	1.5	1,065
44	Ni-9	2.00	2.5	1249	60	4.08	2.8	1,381
45	Ni-9	2.00	2.5	1249	60	4.08	3.1	1,518
46	Ni-9	2.00	2.5	1249	40	2.72	7.1	5,185
47	Ni-9	2.00	2.5	1249	40	2.72	7.7	5,684
48	Ni-9	2.00	2.5	1249	40	4.08	14.2	6,962
49	Ni-9	2.00	2.5	1249	40	4.08	14.6	7,133
50	Ni-9	2.00	2.5	1249	40	6.80	22.0	6,474
51	Ni-9	2.00	2.5	1249	40	6.80	21.2	6,230
52	Ni-9	2.00	2.5	1249	40	6.80	19.1	5,611
53	Ni-10	1.59	2	1255	60	4.08	2.1	1,310
54	Ni-10	1.59	2	1255	60	4.08	2.1	1,267
55	Ni-10	1.59	2	1255	40	2.72	3.1	2,887
56	Ni-10	1.59	2	1255	40	2.72	3.1	2,887
57	Ni-10	1.59	2	1255	40	4.08	5.9	3,622
58	Ni-10	1.59	2	1255	40	4.08	5.4	3,345
59	Ni-10	1.59	2	1255	40	6.80	12.8	4,712
60	Ni-10	1.59	2	1255	40	6.80	12.1	4,476
61	Ni-11	1.69	2.1	1245	60	4.08	0.4	238
62	Ni-11	1.69	2.1	1245	40	2.72	0.5	462
63	Ni-11	4.07	5	1227	40	2.72	1.3	476
64	Ni-11	4.07	5	1227	40	6.80	4.1	595
65	Ni-11	4.07	5	1227	40	6.80	4.1	595

1. TMC was used as a toluene solution (10-15 mg of TMC per 10 ml of dried toluene).

Table 4: Ethylene polymerization examples (Ni-6, Ni-8, Ni-9, Ni-10, Ni-11) – Part B

Run #	Mw	Mn	MWD	Branching	Vinylenes	Trisubs	Vinyls	Vinylidenes
29	81,736	25,035	3.26	7.2	0.06	0.09	0.36	0.02
30	82,255	26,475	3.11	7.0	0.06	0.00	0.37	0.00
31	89,514	27,189	3.29	5.3	0.05	0.03	0.41	0.01
32	88,228	24,977	3.53	5.2	0.07	0.03	0.48	0.00
33	90,015	21,951	4.10	3.6	0.03	0.04	0.47	0.01
34	94,781	23,805	3.98	3.6	0.04	0.02	0.42	0.00
35	81,020	30,462	2.66	28.5	0.22	0.00	0.21	0.01
36	87,174	32,174	2.71	28.4	0.22	0.05	0.24	0.00
37*	163,368	63,581	2.57	10.1	0.09	0.04	0.17	0.03
38*	170,600	68,624	2.49	9.8	0.13	0.06	0.22	0.01
39*	182,533	68,863	2.65	7.3	0.05	0.04	0.22	0.00

40*	177,117	69,642	2.54	6.7	0.07	0.01	0.21	0.00
41*	186,631	73,028	2.56	4.8	0.03	0.03	0.17	0.00
42*	198,810	72,713	2.73	5.4	0.05	0.07	0.22	0.01
43	-	-	-	-	-	-	-	-
44	68,223	35,367	1.93	45.1	0.20	0.02	0.12	0.00
45	74,446	38,081	1.95	43.3	0.23	0.08	0.14	0.01
46*	159,262	78,111	2.04	25.2	0.06	0.05	0.10	0.01
47*	164,038	83,573	1.96	24.8	0.08	0.05	0.07	0.00
48*	195,159	99,784	1.96	16.5	0.04	0.03	0.07	0.01
49*	205,312	104,344	1.97	16.2	0.04	0.01	0.06	0.00
50	-	-	-	-	-	-	-	-
51*	228,227	121,791	1.87	9.6	0.02	0.04	0.10	0.01
52*	239,395	121,472	1.97	11.2	0.05	0.00	0.10	0.04
53	147,019	52,551	2.80	63.3	0.02	0.00	0.00	0.00
54	133,783	53,363	2.51	65.0	0.19	0.02	0.10	0.01
55	228,529	89,684	2.55	45.3	0.07	0.02	0.06	0.00
56	234,777	98,409	2.39	45.6	0.07	0.00	0.00	0.00
57	270,638	128,710	2.10	29.2	0.06	0.01	0.07	0.02
58	262,150	124,119	2.11	34.8	0.07	0.01	0.08	0.02
59	452,163	179,086	2.52	19.2	-	-	-	-
60	409,991	151,694	2.70	22.1	-	-	-	-
61	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-
63	398,463	107,545	3.71	48.9	-	-	-	-
64	716,861	306,698	2.34	45.3	-	-	-	-
65	600,331	256,418	2.34	36.8	-	-	-	-

*Branching by ^{13}C NMR was also measured for examples 37-42, 46-49, and 51-52; the numbers are reported as branches per 1000C. **37**: 8.1 C_1, 0.7 C_2, 0.3 C_3, 0.5 C_4^+; **38**: 8.0 C_1, 0.6 C_2, 0.3 C_3, 0.6 C_4^+; **39**: 6.1 C_1, 0.5 C_2, 0.3 C_3, 0.3 C_4^+; **40**: 6.0 C_1, 0.4 C_2, 0.2 C_3, 0.2 C_4^+; **41**: 4.3 C_1, 0.3 C_2, 0.2 C_3, 0.1 C_4^+; **42**: 4.5 C_1, 0.3 C_2, 0.1 C_3, 0.2 C_4^+; **46**: 17.5 C_1, 1.4 C_2, 1.4 C_3, 3.6 C_4^+; **47**: 17.4 C_1, 1.3 C_2, 1.2 C_3, 3.3 C_4^+; **48**: 12.6 C_1, 0.8 C_2, 0.9 C_3, 1.4 C_4^+; **49**: 12.7 C_1, 0.9 C_2, 0.5 C_3, 2.0 C_4^+; **51**: 8.9 C_1, 0.6 C_2, 0.5 C_3, 0.7 C_4^+; **52**: 7.8 C_1, 0.6 C_2, 0.2 C_3, 0.7 C_4^+;

Table 5: Ethylene polymerization examples (Co-1, Co-Cl) – Part A

Run #	TMC	TMC[1] (μmol)	10 wt% MAO (ml)	Al/M (molar)	Additive[2]	Additive (μmol)	T (°C)	C_2H_4 (atm)	Polymer (g)	Activity
66	Co-1	2.96	1.7	575	none	0	80	4.42	1.4	441
67	Co-1	2.96	1.7	575	none	0	80	4.42	0.9	263
68	Co-1	2.96	1.7	575	none	0	80	4.42	1.8	563
69	Co-1	2.96	1.7	575	none	0	80	4.42	2.6	781
70	Co-1	2.96	1.7	575	none	0	60	4.08	4.3	1,436
71	Co-1	2.96	1.7	575	none	0	60	4.08	3.5	1,151
72	Co-1	2.96	1.7	575	none	0	40	2.72	4.9	2,413
73	Co-1	2.96	1.7	575	none	0	40	2.72	3.5	1,721
74	Co-1	2.96	1.7	575	none	0	40	2.72	7.3	3,616

75	Co-1	2.96	1.7	575	none	0	40	2.72	7.0	3,472
C8	Co-Cl	5.84	3.4	582	none	0	80	4.42	11.7	1,814
C9	Co-Cl	2.92	1.7	582	none	0	80	4.42	5.1	1,565
C10	Co-Cl	2.92	1.7	582	none	0	80	4.42	3.8	1,187
C11	Co-Cl	2.92	1.7	582	none	0	60	3.54	9.3	3,598
C12	Co-Cl	2.92	1.7	582	none	0	60	3.54	11.0	4,256
C13	Co-Cl	2.92	1.7	582	none	0	40	2.72	19.3	9,721
C14	Co-Cl	2.92	1.7	582	none	0	40	2.72	18.2	9,167
76	Co-1	2.96	1.7	575	A	3.0	40	2.72	8.7	4,303
77	Co-1	2.96	1.7	575	A	3.0	40	2.72	9.4	4,651
78	Co-1	2.96	1.7	575	A	6.1	40	2.72	11.1	5,507
79	Co-1	2.96	1.7	575	A	6.1	40	2.72	10.1	5,004
80	Co-1	2.96	1.7	575	A	15.1	40	2.72	7.8	3,865
81	Co-1	2.96	1.7	575	A	15.1	40	2.72	7.4	3,671
82	Co-1	2.96	1.7	575	B	6.0	40	2.72	6.7	3,318
83	Co-1	2.96	1.7	575	B	6.0	40	2.72	7.5	3,726
84	Co-1	2.96	1.7	575	C	6.0	40	2.72	3.5	1,761
85	Co-1	2.96	1.7	575	C	6.0	40	2.72	3.9	1,915
86[3]	Co-1	2.96	1.7	575	none	0	40	2.72	4.1	2,049
87[3]	Co-1	2.96	1.7	575	none	0	40	2.72	1.8	895
88[4]	Co-1	2.96	1.7	575	A	6.1	40	2.72	6.6	3,263
89[4]	Co-1	2.96	1.7	575	A	6.1	40	2.72	6.4	3,184

1. TMC was used as a toluene solution (10-15 mg of TMC per 10 ml of dried toluene).
2. Additive: A = 2,5-di-tert-butyl-1,4-benzoquinone; B: 3,3',5,5'-tetra-tert-butyldiphenylquinone; C: 1,4-benzoquinone. For all experiments, the additive was premixed with the TMC prior to addition to the reactor. Upon addition of the quinone to the TMC, a color change form purple to a shade of green occurs.
3. The TMC was preactivated with 0.5 ml of MAO (10 wt% in toluene) prior to being added to the reactor which contained the balance of the MAO (1.2 ml).
4. The TMC was mixed with the quinone prior to the preactivation with 0.5 ml of MAO (10 wt% in toluene); it was then added to the reactor which contained the balance of the MAO (1.2 ml).

Table 6: Ethylene polymerization examples (Co-1, Co-Cl) – Part B

Run #	Mw	Mn	MWD	Branching	Vinylenes	Trisubs	Vinyls	Vinylidenes
66	-	-	-	-	-	-	-	-
67	1,644	844	1.95	12.5	0.00	0.00	11.40	0.09
68	1,499	862	1.74	11.5	0.00	0.07	11.25	0.09
69	1,299	771	1.68	13.2	0.00	0.00	11.94	0.13
70	1,876	979	1.92	10.8	0.02	0.27	10.21	0.05
71	1,644	999	1.65	10.9	0.02	0.27	10.45	0.05
72	2,308	1,102	2.09	9.6	0.01	0.19	9.33	0.04
73	2,115	1,124	1.88	9.4	0.00	0.09	9.03	0.05
74	2,277	861	2.64	12.4	0.00	0.03	10.71	0.05
75	2,171	940	2.31	12.3	0.00	0.00	10.36	0.04

C8	1,696	1,068	1.59	19.8	0.09	0.72	17.45	0.05
C9	1,718	1,072	1.60	16.1	0.05	0.57	14.85	0.06
C10	2,093	1,356	1.54	13.4	0.05	0.64	12.99	0.05
C11	1,543	1,312	1.18	12.7	0.04	0.40	11.75	0.04
C12	2,168	1,373	1.58	13.4	0.04	0.46	12.47	0.04
C13	2,527	1,455	1.74	11.5	0.05	0.37	10.68	0.04
C14	2,648	1,501	1.76	11.3	0.15	0.82	11.16	0.01
76	2,282	974	2.34	11.2	0.05	0.24	9.84	0.03
77	2,074	871	2.38	10.8	0.00	0.00	9.03	0.03
78	1,923	803	2.39	14.7	0.03	0.15	10.87	0.04
79	1,977	780	2.53	14.3	0.03	0.40	9.88	0.05
80	2,319	998	2.32	11.6	0.02	0.05	8.72	0.03
81	2,246	932	2.41	15.1	0.01	0.09	10.22	0.03
82	2,303	965	2.39	12.4	0.00	0.00	9.95	0.05
83	2,393	1,068	2.24	10.5	0.01	0.10	9.86	0.06
84	5,118	858	5.97	11.5	0.07	0.22	8.42	0.03
85	3,889	1,025	3.79	12.6	0.00	0.00	7.87	0.04
86	339,521	7,273	46.68	9.5	0.00	0.00	1.72	0.41
87	68,632	1,023	67.09	9.4	0.00	0.00	8.64	0.09
88	2,445	947	2.58	12.5	0.00	0.00	9.63	0.05
89	2,757	837	3.29	12.7	0.00	0.00	9.58	0.05

Table 7: Propylene polymerization examples (Ni-1, Ni-6, Ni-8, Ni-9, Ni-10, Ni-11, Ni-Br)

Run #	TMC	TMC[1] (μmol)	10 wt% MAO (ml)	Al/M (molar)	T (°C)	Polymer (g)	Activity	Mw	Mn	MWD
90	Ni-1	3.97	5	1261	40	2.4	1,230	118,966	68,576	1.73
91	Ni-1	3.97	5	1261	40	2.8	1,432	122,181	77,091	1.58
92	Ni-1	5.80	3	518	40	2.8	952	-	-	-
93	Ni-1	9.46	5	529	40	4.3	918	-	-	-
94	Ni-6	9.57	5	522	40	1.7	359	-	-	-
95	Ni-6	9.57	5	522	40	1.7	349	-	-	-
96	Ni-6	9.57	5	522	40	1.6	343	-	-	-
C15	Ni-Br	3.36	1.8	536	40	1.3	774	-	-	-
C16	Ni-Br	6.72	3.6	536	40	2.3	684	-	-	-
C17	Ni-Br	6.72	3.6	536	40	3.1	908	-	-	-
C18	Ni-Br	9.58	5	522	40	4.0	825	119,904	72,726	1.65
C19	Ni-Br	9.58	5	522	40	6.0	1,261	114,823	65,255	1.76
97	Ni-8	9.51	5	526	40	2.0	425	-	-	-
98	Ni-9	9.51	5	526	40	1.2	242	-	-	-
99	Ni-10	9.56	5	523	40	1.2	247	-	-	-
100	Ni-11	9.55	5	523	40	0.7	142	-	-	-

1. TMC was used as a toluene solution (10-15 mg of TMC per 10 ml of toluene) with the exception of NiBr that was added as a toluene slurry because of its poor solubility in toluene.

Table 8: Ethylene/Propylene (EP) or Ethylene/1-Hexene (EH) copolymerization examples (Co-1) – Part A

Run #	Run Type	TMC[1]	TMC (μmol)	10 wt% MAO (ml)	Al/M	T (°C)	C_2H_4 (atm)	Polymer (g)	Activity
101	EP	Co-1	5.910	3.4	575	80	4.76	0.8	107
102	EP	Co-1	5.910	3.4	575	80	4.76	1.0	138
103	EP	Co-1	5.910	3.4	575	40	3.27	1.4	286
104	EP	Co-1	5.910	3.4	575	40	3.27	1.1	222
105	EH	Co-1	2.955	1.7	575	80	4.42	0.6	184
106	EH	Co-1	2.955	1.7	575	80	4.42	0.5	141
107	EH	Co-1	5.910	3.4	575	80	4.42	2.1	328
108	EH	Co-1	5.910	3.4	575	40	2.38	3.7	1,063
109	EH	Co-1	5.910	3.4	575	40	2.38	2.9	816

1. TMC was used as a toluene solution (10-15 mg of TMC per 10 ml of dried toluene).

Table 9: Ethylene/Propylene (EP) or Ethylene/1-Hexene (EH) copolymerization examples (Co-1) – Part B

Run #	Mw	Mn	MWD	Branching	Vinylenes	Trisubs	Vinyls	Vinylidenes
101	-	-	-	-	-	-	-	-
102	2,060	1,174	1.75	20.7	1.18	0.85	13.50	0.12
103	-	-	-	-	-	-	-	-
104	-	-	-	-	-	-	-	-
105	1,062	555	1.91	17.2	0.37	0.26	15.23	0.08
106	1,253	767	1.63	13.9	0.31	0.20	12.89	0.08
107	1,475	841	1.75	12.4	0.23	0.07	11.29	0.10
108	1,910	1,091	1.75	10.5	0.14	0.10	9.69	0.05
109	1,873	1,049	1.79	10.8	0.15	0.14	9.74	0.05

Table 10: Ethylene polymerization examples (Ni-1, Ni-2, Ni-3, Ni-6, Ni-8, Ni-9, Ni-10, Ni-11, Ni-Br, Co-1, Co-2, Co-Cl).

Run #	TMC	T (°C)	C_2H_4 guage pressure (atm)	Rxn time (sec)	Polymer (mg)	Activity	Mw	Mn	MWD	Tm (°C)
110	Ni-1	40	7.07	42	176.9	10,729	77,067	48,382	1.59	121.3
111	Ni-1	60	7.21	34	146.3	10,811	56,936	35,838	1.59	103.6
112	Ni-1	80	7.35	37	100.6	6,663	38,047	24,924	1.53	104.6
113	Ni-1	40	7.07	71	193.8	6,954	100,709	62,948	1.60	121.8
114	Ni-1	60	7.21	38	136.2	9,037	62,187	40,630	1.53	113.1
115	Ni-1	80	7.35	37	102.3	6,734	41,503	26,842	1.55	138.7
116	Ni-2	40	7.07	38	178.7	11,862	78,911	47,925	1.65	117.1
117	Ni-2	60	7.21	33	150.2	11,256	54,307	34,654	1.57	125.1

118	Ni-2	80	7.35	39	97.3	6,192	37,208	23,798	1.56	123.4
119	Ni-2	40	7.07	66	191.4	7,429	84,175	49,409	1.70	122.0
120	Ni-2	60	7.21	35	151.1	10,930	54,667	34,373	1.59	110.4
121	Ni-2	80	7.35	48	99.7	5,138	39,278	25,187	1.56	136.1
122	Ni-3	40	7.07	57	190.9	8,470	82,064	48,280	1.70	122.2
123	Ni-3	60	7.21	32	148.4	11,583	53,965	33,630	1.60	107.2
124	Ni-3	80	7.35	39	83.2	5,248	38,740	24,203	1.60	137.6
125	Ni-3	40	7.07	48	191.2	10,203	82,836	48,995	1.69	121.8
126	Ni-3	60	7.21	32	149.0	11,487	53,510	32,708	1.64	112.2
127	Ni-3	80	7.35	46	98.4	5,248	38,594	24,875	1.55	108.5
128	Ni-8	40	7.07	44	173.2	9,986	89,456	55,489	1.61	122.6
129	Ni-8	60	7.21	39	124.6	7,930	63,196	41,812	1.51	110.6
130	Ni-8	80	7.35	57	79.7	3,407	43,678	27,598	1.58	112.1
131	Ni-8	40	7.07	46	174.2	9,711	98,869	60,135	1.64	122.5
132	Ni-8	60	7.21	42	126.8	7,508	57,570	37,886	1.52	122.3
133	Ni-8	80	7.35	53	89.9	4,193	42,198	27,887	1.51	133.3
134	Ni-9	40	7.07	77	163.9	5,421	172,060	107,940	1.59	104.5
135	Ni-9	60	7.21	63	119.8	4,781	105,868	72,106	1.47	85.8
136	Ni-9	80	7.35	80	80.7	2,476	63,348	43,698	1.45	106.0
137	Ni-9	40	7.07	73	167.5	5,806	177,050	111,809	1.58	106.1
138	Ni-9	60	7.21	61	119.9	4,904	103,663	70,959	1.46	107.5
139	Ni-9	80	7.35	75	84.0	2,732	67,769	46,888	1.45	115.9
140	Ni-10	40	7.07	118	162.3	3,487	263,107	160,249	1.64	90.4
141	Ni-10	60	7.21	90	108.2	2,985	168,080	104,528	1.61	120.5
142	Ni-10	80	7.35	95	81.3	2,090	107,404	67,343	1.59	124.6
143	Ni-10	40	7.07	106	168.2	4,042	270,980	165,541	1.64	93.1
144	Ni-10	60	7.21	87	101.2	2,901	161,539	101,155	1.60	100.4
145	Ni-10	80	7.35	99	86.1	2,129	113,885	73,169	1.56	171.5
146	Ni-6	40	7.07	38	164.6	11,000	48,864	29,957	1.63	129.2
147	Ni-6	60	7.21	35	120.9	8,657	36,260	22,169	1.64	121.4
148	Ni-6	80	7.35	68	66.4	2,378	26,507	15,556	1.70	135.7
149	Ni-6	40	7.07	75	175.2	5,910	58,857	32,777	1.80	128.3
150	Ni-6	60	7.21	33	119.7	9,143	36,086	22,409	1.61	119.8
151	Ni-6	80	7.35	56	81.8	3,598	25,417	15,704	1.62	135.3
C20	Ni-Br	40	7.07	472	158.0	852	168,529	102,309	1.65	118.4
C21	Ni-Br	60	7.21	64	117.2	4,552	78,541	51,465	1.53	107.8
C22	Ni-Br	80	7.35	111	63.1	1,397	54,377	36,370	1.50	112.9
C23	Ni-Br	40	7.07	450	161.6	913	172,099	104,225	1.65	116.5
C24	Ni-Br	60	7.21	78	109.3	3,489	81,635	54,796	1.49	113.6
C25	Ni-Br	80	7.35	108	69.3	1,572	59,366	40,351	1.47	113.4
152	Ni-1	40	7.07	55	209.1	9,692	72,317	38,502	1.88	129.5
153	Ni-1	40	4.35	67	175.0	10,804	97,858	60,047	1.63	115.7
154	Ni-1	40	2.99	77	106.6	8,278	89,328	57,917	1.54	109.5
155	Ni-1	40	7.07	124	213.2	4,386	101,881	61,024	1.67	120.9
156	Ni-1	40	4.35	74	157.1	8,769	100,260	62,200	1.61	115.3
157	Ni-1	40	2.99	77	129.3	10,103	99,737	63,357	1.57	111.0
158	Ni-2	40	7.07	42	194.5	11,710	83,290	50,016	1.67	120.8

159	Ni-2	40	4.35	48	147.7	12,598	86,218	53,339	1.62	116.1
160	Ni-2	40	2.99	65	108.7	10,010	77,652	49,475	1.57	109.9
161	Ni-2	40	7.07	79	215.3	6,899	94,313	56,149	1.68	121.2
162	Ni-2	40	4.35	53	138.8	10,827	84,573	51,221	1.65	115.9
163	Ni-2	40	2.99	67	119.8	10,825	82,149	52,349	1.57	112.2
164	Ni-3	40	7.07	79	201.8	6,474	89,492	53,829	1.66	121.4
165	Ni-3	40	4.35	52	142.4	11,352	84,019	51,709	1.62	115.7
166	Ni-3	40	2.99	69	110.3	9,581	78,711	49,367	1.59	112.2
167	Ni-3	40	7.07	43	191.9	11,450	86,291	51,413	1.68	120.7
168	Ni-3	40	4.35	50	139.4	11,627	82,953	50,043	1.66	116.6
169	Ni-3	40	2.99	73	117.4	9,619	81,032	50,849	1.59	111.2
170	Ni-8	40	7.07	91	197.7	5,513	108,924	64,101	1.70	121.9
171	Ni-8	40	4.35	59	136.2	9,585	95,295	58,705	1.62	117.1
172	Ni-8	40	2.99	72	105.9	8,812	88,202	54,778	1.61	113.1
173	Ni-8	40	7.07	51	183.1	9,152	101,725	61,169	1.66	121.7
174	Ni-8	40	4.35	63	131.4	8,641	92,283	56,367	1.64	118.6
175	Ni-8	40	2.99	74	106.9	8,669	89,588	55,490	1.61	114.3
176	Ni-9	40	7.07	81	186.1	5,876	179,103	113,522	1.58	100.1
177	Ni-9	40	4.35	89	121.1	5,600	182,221	118,953	1.53	91.6
178	Ni-9	40	2.99	124	88.2	4,263	159,771	109,184	1.46	86.2
179	Ni-9	40	7.07	81	214.0	6,688	190,939	116,634	1.64	102.7
180	Ni-9	40	4.35	85	118.3	5,766	171,377	113,636	1.51	93.3
181	Ni-9	40	2.99	120	96.0	4,813	170,123	116,765	1.46	74.4
182	Ni-10	40	7.07	123	183.3	3,784	270,211	164,727	1.64	88.5
183	Ni-10	40	4.35	139	104.8	3,123	252,326	160,659	1.57	92.9
184	Ni-10	40	2.99	178	83.1	2,815	227,347	145,921	1.56	69.0
185	Ni-10	40	7.07	103	168.4	4,152	270,271	166,297	1.63	88.5
186	Ni-10	40	4.35	133	99.6	3,102	247,965	157,896	1.57	80.9
187	Ni-10	40	2.99	165	83.0	3,031	234,378	152,875	1.53	78.1
188	Ni-6	40	7.07	109	194.0	4,513	64,597	34,939	1.85	135.0
189	Ni-6	40	4.35	112	136.0	5,025	61,331	33,762	1.82	113.8
190	Ni-6	40	2.99	201	112.5	3,358	61,035	32,376	1.89	124.7
191	Ni-6	40	7.07	147	202.6	3,502	68,978	36,113	1.91	112.9
192	Ni-6	40	4.35	73	129.0	7,332	52,612	30,332	1.73	128.6
193	Ni-6	40	2.99	122	115.1	5,651	59,014	32,399	1.82	125.7
C26	Ni-Br	40	7.07	342	161.3	1,198	165,753	102,421	1.62	121.0
C27	Ni-Br	40	4.35	244	113.9	1,929	168,900	108,771	1.55	117.7
C28	Ni-Br	40	2.99	163	84.1	3,104	152,583	97,274	1.57	110.0
C29	Ni-Br	40	7.07	241	156.4	1,654	169,317	112,718	1.50	117.0
C30	Ni-Br	40	4.35	174	101.9	2,421	166,677	108,907	1.53	115.8
C31	Ni-Br	40	2.99	171	87.0	3,056	159,536	102,535	1.56	108.5
194	Ni-1	40	7.07	46	183.9	10,252	78,058	47,868	1.63	121.0
195	Ni-1	60	7.21	34	148.1	10,873	55,361	35,052	1.58	102.1
196	Ni-1	80	7.35	37	99.5	6,532	37,978	25,013	1.52	114.4
197	Ni-1	40	7.07	51	170.1	8,553	84,468	52,113	1.62	122.7
198	Ni-1	60	7.21	33	142.4	10,844	56,766	36,762	1.54	102.2
199	Ni-1	80	7.35	34	101.9	7,347	40,006	26,575	1.51	119.8

200	Ni-1*	40	7.07	44	175.4	10,033	85,163	51,749	1.65	120.1
201	Ni-1*	60	7.21	35	145.5	10,371	55,132	35,536	1.55	102.8
202	Ni-1*	80	7.35	38	97.9	6,274	38,466	24,381	1.58	130.7
203	Ni-1*	40	7.07	51	185.4	9,231	83,126	50,397	1.65	120.9
204	Ni-1*	60	7.21	37	137.4	9,394	56,035	36,062	1.55	100.6
205	Ni-1*	80	7.35	37	99.5	6,550	38,787	24,821	1.56	111.3
206	Co-1	40	7.07	127	190.0	3,817	3,981	2,842	1.40	122.4
207	Co-1	60	7.21	66	114.2	4,306	3,199	2,446	1.31	157.5
208	Co-1	80	7.35	69	96.7	3,444	2,772	2,212	1.25	113.8
209	Co-1	40	7.07	132	191.7	3,699	3,808	2,774	1.37	112.4
210	Co-1	60	7.21	65	106.5	4,092	3,241	2,540	1.28	103.3
211	Co-1	80	7.35	69	97.7	3,467	2,626	2,117	1.24	105.3
C32	Co-Cl	40	7.07	40	156.8	10,008	2,988	2,394	1.25	111.4
C33	Co-Cl	60	7.21	27	136.9	12,780	2,758	2,258	1.22	144.3
C34	Co-Cl	80	7.35	30	117.4	9,629	2,456	2,076	1.18	134.8
C35	Co-Cl	40	7.07	38	156.8	10,571	3,070	2,442	1.26	126.1
C36	Co-Cl	60	7.21	29	133.0	11,612	2,730	2,246	1.22	123.7
C37	Co-Cl	80	7.35	30	118.2	9,592	2,340	1,979	1.18	130.0
212	Co-2	40	7.07	901	10.6	30	-	-	-	-
213	Co-2	60	7.21	652	11.4	44	-	-	-	-
214	Co-2	80	7.35	901	7.9	21	-	-	-	-
215	Co-2	40	7.07	900	13.2	37	-	-	-	-
216	Co-2	60	7.21	415	11.8	71	-	-	-	-
217	Co-2	80	7.35	901	8.4	23	-	-	-	-
218	Ni-11	40	7.07	362	103.5	727	612,779	371,393	1.65	78.0
219	Ni-11	60	7.21	568	54.0	237	571,547	252,259	2.27	132.3
220	Ni-11	80	7.35	900	35.5	97	452,269	147,900	3.06	97.4
221	Ni-11	40	7.07	311	114.4	935	623,344	377,286	1.65	75.7
222	Ni-11	80	7.35	901	30.9	84	391,893	134,195	2.92	99.7
C38	Ni-Br	40	7.07	334	134.9	1,028	163,988	108,366	1.51	118.9
C39	Ni-Br	60	7.21	72	114.6	3,962	78,822	55,385	1.42	101.0
C40	Ni-Br	80	7.35	86	74.0	2,111	51,076	34,247	1.49	77.8
C41	Ni-Br	40	7.07	292	150.2	1,309	162,370	107,124	1.52	121.3
C42	Ni-Br	60	7.21	85	101.1	2,955	83,511	57,398	1.45	103.7
C43	Ni-Br	80	7.35	85	73.7	2,115	53,788	37,009	1.45	125.1
223	Ni-1	40	7.07	49	189.9	9,772	82,825	52,635	1.57	117.2
224	Ni-1	40	4.35	46	153.1	13,778	79,559	51,814	1.54	110.8
225	Ni-1	40	2.99	66	106.4	9,655	73,307	48,486	1.51	105.2
226	Ni-1	40	7.07	61	195.4	8,157	84,378	51,810	1.63	116.5
227	Ni-1	40	4.35	58	139.9	10,021	87,313	57,320	1.52	112.5
228	Ni-1	40	2.99	71	122.9	10,471	78,058	51,257	1.52	107.2
229	Ni-1*	40	7.07	43	185.3	10,979	79,770	50,262	1.59	117.2
230	Ni-1*	40	4.35	48	138.5	11,880	78,803	50,304	1.57	110.8
231	Ni-1*	40	2.99	67	109.3	9,742	75,232	49,695	1.51	105.1
232	Ni-1*	40	7.07	54	183.5	8,673	95,522	60,932	1.57	115.4
233	Ni-1*	40	4.35	65	142.0	9,021	90,277	58,638	1.54	111.8
234	Ni-1*	40	2.99	68	116.6	10,277	78,624	52,944	1.49	107.2

235	Co-1	40	7.07	117	152.3	3,306	5,413	3,058	1.77	128.3
236	Co-1	40	4.35	144	150.3	4,319	4,153	2,988	1.39	99.8
237	Co-1	40	2.99	174	105.7	3,654	4,380	3,090	1.42	103.2
238	Co-1	40	7.07	101	191.8	4,827	3,813	2,822	1.35	111.7
239	Co-1	40	4.35	120	120.3	4,151	4,104	3,031	1.35	126.4
240	Co-1	40	2.99	176	108.5	3,703	4,183	2,994	1.40	125.2
C44	Co-Cl	40	7.07	31	150.1	12,166	3,384	2,672	1.27	105.8
C45	Co-Cl	40	4.35	32	105.9	13,631	3,480	2,690	1.29	117.0
C46	Co-Cl	40	2.99	62	102.3	9,948	3,636	2,797	1.30	104.5
C47	Co-Cl	40	7.07	15	116.6	19,276	3,384	2,649	1.28	108.5
C48	Co-Cl	40	4.35	42	111.8	10,961	3,637	2,816	1.29	116.0
241	Co-2	40	2.99	901	6.6	44	-	-	-	-
242	Co-2	40	7.07	464	6.4	35	-	-	-	-
243	Co-2	40	4.35	902	6.2	28	-	-	-	-
244	Co-2	40	2.99	901	6.5	43	-	-	-	-
245	Ni-11	40	7.07	284	113.9	1,020	665,141	423,947	1.57	80.0
246	Ni-11	40	4.35	287	64.4	927	523,696	331,938	1.58	70.1
247	Ni-11	40	2.99	510	49.6	585	495,788	306,402	1.62	62.3
248	Ni-11	40	7.07	280	115.7	1,052	593,274	387,252	1.53	79.8
249	Ni-11	40	4.35	223	67.1	1,244	510,000	332,886	1.53	67.0
250	Ni-11	40	2.99	360	41.1	686	454,760	285,715	1.59	58.7
251	Ni-Br	40	2.99	150	78.1	3,132	145,653	95,837	1.52	107.7
252	Ni-Br	40	7.07	229	154.9	1,721	159,791	105,261	1.52	115.6
253	Ni-Br	40	4.35	146	96.2	2,728	157,079	104,711	1.50	110.1
254	Ni-Br	40	2.99	157	84.8	3,245	142,170	93,103	1.53	105.6

Standard Reaction Conditions: TMC (0.20 μmol) delivered as a 100 μL of a 0.002 M solution in toluene except for Ni-Br and Co-Cl; Ni-Br and Co-Cl were prepared at the same concentrations indicated, however, these materials were not completely soluble in toluene. Because of this, the vials were shaken well before removing 100 μL of the suspended transition metal compound. 10 wt% MAO in toluene (100 μmol) delivered as 132.4 μL of a 0.755 M solution in toluene; Al/M molar ratio = 500; Toluene was used as the reactor solvent and delivered to the reactor for a total volume of 5 mL. Ni-1* was an aged Ni-1 solution that was stored overnight in a freezer.

Table 11: Ethylene polymerization examples using mixed activators (Ni-1, Ni-2, Ni-3, Ni-6, Co-1 with MAO or MAO/A1 or MAO/A2 or TMA/A2).

Run #	TMC	Activator 1*	Activator 2	Activator 1 (μmol)	Rxn time (sec)	Polymer (mg)	Activity	Mw	Mn	MWD	Tm (°C)
255	Ni-1	MAO	-	20.00	40	156.0	10,015	83,884	52,790	1.59	114.9
256	Ni-2	MAO	-	20.00	34	158.0	11,893	71,708	43,775	1.64	110.7
257	Ni-3	MAO	-	20.00	40	145.3	9,141	81,788	48,055	1.70	181.0
258	Co-1	MAO	-	20.00	106	90.3	2,167	4,078	2,991	1.36	115.9
259	Ni-6	MAO	-	20.00	60	161.8	6,914	52,435	26,602	1.97	122.9
260	Ni-1	MAO	-	20.00	33	147.8	11,255	78,056	44,973	1.74	111.7
261	Ni-2	MAO	-	20.00	34	151.6	11,411	82,865	45,131	1.84	114.0

262	Ni-3	MAO	-	20.00	39	145.2	9,588	86,959	48,074	1.81	114.0
263	Co-1	MAO	-	20.00	102	118.4	2,959	4,472	3,106	1.44	117.4
264	Ni-6	MAO	-	20.00	39	151.4	9,982	52,523	25,759	2.04	122.5
265	Ni-1	MAO	A1	19.78	40	158.1	10,026	80,025	46,375	1.73	113.1
266	Ni-2	MAO	A1	19.78	34	157.2	11,627	75,165	43,170	1.74	110.7
267	Ni-3	MAO	A1	19.78	38	149.6	10,053	80,174	46,800	1.71	112.1
268	Co-1	MAO	A1	19.78	123	141.0	2,916	4,306	3,070	1.40	122.6
269	Ni-6	MAO	A1	19.78	52	157.8	7,748	53,118	27,358	1.94	122.7
270	Ni-1	MAO	A1	19.78	37	152.2	10,460	74,189	44,992	1.65	114.8
271	Ni-2	MAO	A1	19.78	34	152.7	11,532	72,435	44,968	1.61	109.4
272	Ni-3	MAO	A1	19.78	38	146.1	9,787	77,929	45,657	1.71	113.1
273	Co-1	MAO	A1	19.78	101	106.3	2,681	4,352	3,078	1.41	147.6
274	Ni-6	MAO	A1	19.78	55	160.4	7,377	51,138	26,817	1.91	122.8
275	Ni-1	MAO	A2	19.78	33	155.2	11,791	69,847	43,371	1.61	110.4
276	Ni-2	MAO	A2	19.78	33	158.2	12,385	67,189	41,846	1.61	108.7
277	Ni-3	MAO	A2	19.78	35	147.4	10,618	72,646	45,636	1.59	109.4
278	Co-1	MAO	A2	19.78	119	104.5	2,243	4,282	2,978	1.44	123.6
279	Ni-6	MAO	A2	19.78	36	146.9	10,519	50,696	28,162	1.80	121.1
280	Ni-1	MAO	A2	19.78	35	155.2	11,327	71,985	42,811	1.68	111.3
281	Ni-2	MAO	A2	19.78	32	156.8	12,428	71,752	42,883	1.67	111.4
282	Ni-3	MAO	A2	19.78	36	149.7	10,702	73,112	43,215	1.69	112.4
283	Co-1	MAO	A2	19.78	125	104.5	2,135	4,139	2,995	1.38	124.3
284	Ni-6	MAO	A2	19.78	37	150.7	10,479	50,445	27,533	1.83	121.4
285	Ni-1	TMA	A2	19.78	47	139.9	7,610	75,851	47,421	1.60	113.8
286	Ni-2	TMA	A2	19.78	44	146.6	8,385	66,872	41,129	1.63	113.5
287	Ni-3	TMA	A2	19.78	52	137.2	6,724	75,789	48,418	1.57	109.5
288	Co-1	TMA	A2	19.78	900	14.0	40	-	-	-	-
289	Ni-6	TMA	A2	19.78	41	142.0	8,733	52,146	28,958	1.80	120.5
290	Ni-1	TMA	A2	19.78	47	137.6	7,387	77,176	49,243	1.57	110.4
291	Ni-2	TMA	A2	19.78	43	148.6	8,869	71,239	44,054	1.62	108.2
292	Ni-3	TMA	A2	19.78	50	133.1	6,739	78,985	51,147	1.54	112.0
293	Co-1	TMA	A2	19.78	900	18.5	52	3,968	2,788	1.42	96.8
294	Ni-6	TMA	A2	19.78	40	141.9	8,996	52,910	29,557	1.79	121.2

Standard Conditions: TMC (0.20 μmol) delivered as a 100 μL of a 0.002 M solution in toluene; 10 wt% Albemarle MAO when used delivered as a 0.3 M solution in toluene; TMA when used delivered as a 0.2 M solution in toluene; A1 (0.22 μmol) when used delivered as a 110 μL of a 0.002 M solution in toluene; A2 (0.22 μmol) when used delivered as 733.3 μL of a 0.0003 M solution in toluene; Al/M molar ratio = 100 for runs with MAO only, 99 for runs with mixed activators; B/M molar ratio = 1.1 when second activator was used; Toluene was used as the reactor solvent and delivered to the reactor for a total volume of 5 mL; reaction temperature, 40 °C; ethylene gauge pressure 7.07 atmospheres; Activators: A1 = tris(perfluorophenyl)boron, A2 = dimethylanilinium tetrakis(perfluorophenyl)borate, MAO = methylalumoxane (10 wt% in toluene), TMA = trimethyl aluminum (NEAT).
*When Activator 2 was used, Activator 1 was the co-activator.

Table 12: (Ni-1, Ni-2, Ni-6 with MAO or MAO/A1 or MAO/A2 or TMA/A1 or TMA/A2).

Run #	TMC	Activator 1*	Activator 2	Activator 1 µmol	Al/M molar	Rxn time (sec)	Polymer (mg)	Activity	Mw	Mn	MWD	Tm (°C)
295	Ni-1	MAO	A1	1.78	9	54	156.8	7,426	91,817	57,959	1.58	118.4
296	Ni-1	MAO	A2	1.78	9	44	154.7	9,036	87,230	56,362	1.55	115.9
297	Ni-1	MAO	-	2.00	10	42	146.9	8,984	91,234	57,485	1.59	117.8
298	Ni-1	MAO	-	2.00	10	118	157.2	3,389	102,189	63,036	1.62	118.7
299	Ni-1	MAO	A2	1.78	9	47	149.8	8,132	86,329	55,552	1.55	115.1
300	Ni-1	MAO	A1	1.78	9	55	160.2	7,420	98,673	62,638	1.58	117.7
301	Ni-1	MAO	A1	4.78	24	58	176.7	7,785	91,826	57,903	1.59	117.8
302	Ni-1	MAO	A2	4.78	24	45	159.2	8,971	86,598	56,189	1.54	115.3
303	Ni-1	MAO	-	5.00	25	43	161.5	9,529	93,925	62,011	1.51	116.5
304	Ni-1	MAO	-	5.00	25	78	181.4	5,951	101,465	65,948	1.54	117.9
305	Ni-1	MAO	A2	4.78	24	48	162.6	8,577	82,796	53,200	1.56	115.0
306	Ni-1	MAO	A1	4.78	24	59	174.4	7,531	98,413	63,468	1.55	119.0
307	Ni-1	MAO	A1	9.78	49	40	184.5	11,845	81,899	51,244	1.60	116.3
308	Ni-1	MAO	A2	9.78	49	44	165.6	9,628	81,913	50,964	1.61	116.2
309	Ni-1	MAO	-	10.00	50	48	162.4	8,590	82,919	52,189	1.59	116.1
310	Ni-1	MAO	-	10.00	50	50	184.1	9,351	82,990	51,866	1.60	116.8
311	Ni-1	MAO	A2	9.78	49	44	168.9	9,733	78,871	49,032	1.61	117.2
312	Ni-1	MAO	A1	9.78	49	53	165.0	7,933	88,849	56,049	1.59	117.6
313	Ni-1	MAO	A1	14.78	74	94	216.9	5,880	89,040	55,050	1.62	115.2
314	Ni-1	MAO	-	15.00	75	54	182.3	8,523	83,492	50,332	1.66	117.1
315	Ni-1	MAO	-	15.00	75	45	193.1	11,020	83,007	51,361	1.62	116.6
316	Ni-1	MAO	A2	14.78	74	45	174.0	9,917	77,017	47,454	1.62	115.4
317	Ni-1	MAO	A1	14.78	74	53	174.5	8,432	88,481	55,333	1.60	116.7
318	Ni-6	MAO	A1	1.78	9	90	163.1	4,611	54,731	31,877	1.72	125.5
319	Ni-6	MAO	A2	1.78	9	58	154.7	6,779	53,679	32,146	1.67	125.0
320	Ni-6	MAO	-	2.00	10	58	145.6	6,442	52,444	30,648	1.71	124.3
321	Ni-6	MAO	-	2.00	10	127	164.0	3,275	57,618	32,354	1.78	124.9
322	Ni-6	MAO	A2	1.78	9	51	150.2	7,492	50,094	29,503	1.70	123.7
323	Ni-6	MAO	A1	1.78	9	76	154.8	5,212	56,174	32,675	1.72	125.6
324	Ni-6	MAO	A1	4.78	24	66	172.6	6,686	52,356	29,541	1.77	125.8
325	Ni-6	MAO	A2	4.78	24	61	159.3	6,664	52,121	31,381	1.66	124.6
326	Ni-6	MAO	-	5.00	25	43	158.3	9,419	48,622	29,054	1.67	124.7
327	Ni-6	MAO	-	5.00	25	147	176.9	3,056	61,161	33,747	1.81	122.2
328	Ni-6	MAO	A2	4.78	24	67	154.2	5,883	51,920	30,426	1.71	124.2
329	Ni-6	MAO	A1	4.78	24	71	168.9	6,060	56,700	32,419	1.75	126.0
330	Ni-6	MAO	A1	9.78	49	111	189.8	4,354	61,991	33,306	1.86	126.7
331	Ni-6	MAO	A2	9.78	49	80	158.9	5,029	57,716	34,165	1.69	126.3
332	Ni-6	MAO	-	10.00	50	79	154.8	4,963	59,840	33,905	1.76	127.1
333	Ni-6	MAO	-	10.00	50	75	154.5	5,261	58,395	33,508	1.74	125.0
334	Ni-6	MAO	A2	9.78	49	68	158.5	5,913	55,689	32,052	1.74	124.9
335	Ni-6	MAO	A1	9.78	49	75	151.4	5,163	62,699	36,307	1.73	125.3

336	Ni-6	MAO	A1	14.78	74	110	193.3	4,469	59,693	32,179	1.86	130.0
337	Ni-6	MAO	A2	14.78	74	69	168.7	6,250	56,895	32,996	1.72	122.9
338	Ni-6	MAO	-	15.00	75	90	166.0	4,713	62,338	35,443	1.76	125.6
339	Ni-6	MAO	-	15.00	75	117	180.0	3,905	63,200	34,756	1.82	124.8
340	Ni-6	MAO	A2	14.78	74	61	169.0	7,070	52,059	30,139	1.73	122.1
341	Ni-6	MAO	A1	14.78	74	90	178.0	5,060	64,214	36,384	1.76	124.0
342	Ni-1	TMA	A1	2.00	10	157	103.1	1,671	146,455	98,919	1.48	112.2
343	Ni-6	TMA	A1	2.00	10	275	80.9	750	106,140	69,965	1.52	124.8
344	Ni-2	TMA	A1	2.00	10	375	54.5	370	188,129	124,447	1.51	114.7
345	Ni-2	TMA	A1	2.00	10	181	110.6	1,555	149,665	100,009	1.50	110.8
346	Ni-6	TMA	A1	2.00	10	256	74.9	745	105,130	68,035	1.55	125.8
347	Ni-1	TMA	A1	2.00	10	406	73.1	458	194,305	129,381	1.50	116.8
348	Ni-1	TMA	A1	5.00	25	124	135.0	2,770	115,795	77,806	1.49	112.5
349	Ni-6	TMA	A1	5.00	25	207	129.2	1,588	89,879	57,408	1.57	120.9
350	Ni-2	TMA	A1	5.00	25	151	120.3	2,034	130,633	87,091	1.50	110.7
351	Ni-2	TMA	A1	5.00	25	135	132.6	2,507	124,950	84,996	1.47	112.5
352	Ni-6	TMA	A1	5.00	25	166	118.9	1,823	88,781	57,264	1.55	123.3
353	Ni-1	TMA	A1	5.00	25	143	114.3	2,031	147,041	98,116	1.50	109.5
354	Ni-1	TMA	A1	10.00	50	87	141.8	4,136	96,514	62,825	1.54	113.4
355	Ni-6	TMA	A1	10.00	50	231	139.6	1,537	64,938	39,570	1.64	122.1
356	Ni-2	TMA	A1	10.00	50	75	144.7	4,896	92,480	60,169	1.54	113.2
357	Ni-2	TMA	A1	10.00	50	88	143.8	4,148	104,302	70,171	1.49	112.2
358	Ni-6	TMA	A1	10.00	50	170	135.5	2,027	62,697	38,252	1.64	135.4
359	Ni-1	TMA	A1	10.00	50	91	146.8	4,085	103,151	67,739	1.52	113.5
360	Ni-1	TMA	A1	15.00	75	109	145.7	3,397	96,471	62,387	1.55	111.9
361	Ni-6	TMA	A1	15.00	75	192	142.4	1,885	64,553	38,830	1.66	122.0
362	Ni-2	TMA	A1	15.00	75	75	151.0	5,113	90,443	58,800	1.54	124.0
363	Ni-2	TMA	A1	15.00	75	80	142.6	4,552	94,299	61,064	1.54	112.9
364	Ni-6	TMA	A1	15.00	75	130	137.7	2,691	61,719	37,891	1.63	122.0
365	Ni-1	TMA	A1	15.00	75	98	148.5	3,868	101,049	65,521	1.54	112.4
366	Ni-1	TMA	A2	2.00	10	149	149.9	2,553	102,410	66,282	1.55	114.0
367	Ni-6	TMA	A2	2.00	10	901	140.1	396	90,418	57,349	1.58	122.7
368	Ni-2	TMA	A2	2.00	10	454	123.1	690	156,390	103,163	1.52	111.6
369	Ni-2	TMA	A2	2.00	10	164	139.0	2,157	120,844	80,106	1.51	114.4
370	Ni-6	TMA	A2	2.00	10	300	121.8	1,032	100,174	64,285	1.56	122.9
371	Ni-1	TMA	A2	2.00	10	321	115.3	915	156,978	104,544	1.50	113.1
372	Ni-1	TMA	A2	5.00	25	118	143.3	3,086	102,604	67,939	1.51	115.3
373	Ni-6	TMA	A2	5.00	25	757	150.0	504	76,173	46,002	1.66	124.2
374	Ni-2	TMA	A2	5.00	25	165	136.8	2,111	114,237	75,489	1.51	114.3
375	Ni-2	TMA	A2	5.00	25	142	139.5	2,503	113,012	74,812	1.51	114.9
376	Ni-6	TMA	A2	5.00	25	385	146.3	968	83,081	53,432	1.55	122.6
377	Ni-1	TMA	A2	5.00	25	189	136.4	1,834	126,623	84,553	1.50	114.1
378	Ni-1	TMA	A2	10.00	50	115	153.6	3,399	94,083	60,330	1.56	122.2
379	Ni-6	TMA	A2	10.00	50	677	157.8	593	70,837	41,099	1.72	125.5
380	Ni-2	TMA	A2	10.00	50	170	150.2	2,249	101,164	65,306	1.55	115.8
381	Ni-2	TMA	A2	10.00	50	189	156.0	2,096	97,868	62,683	1.56	116.8
382	Ni-6	TMA	A2	10.00	50	464	151.6	831	69,995	41,589	1.68	124.7

383	Ni-1	TMA	A2	10.00	50	129	142.0	2,806	110,684	73,014	1.52	114.9
384	Ni-1	TMA	A2	15.00	75	114	153.4	3,425	93,140	59,083	1.58	119.3
385	Ni-6	TMA	A2	15.00	75	170	152.4	2,281	61,974	37,256	1.66	125.5
386	Ni-2	TMA	A2	15.00	75	120	143.0	3,034	97,854	63,411	1.54	115.6
387	Ni-2	TMA	A2	15.00	75	109	144.5	3,358	98,526	63,446	1.55	114.8
388	Ni-6	TMA	A2	15.00	75	125	144.4	2,929	60,326	36,295	1.66	125.9
389	Ni-1	TMA	A2	15.00	75	123	146.2	3,032	101,704	65,386	1.56	114.1

Standard Conditions: TMC (0.20 μmol) delivered as a 100 μL of a 0.002 M solution in toluene; 10 wt% MAO in toluene when used delivered as a 0.0597 M solution in toluene; TMA when used delivered as a 0.05 M solution in toluene; A1 (0.22 μmol) when used delivered as a 110 μL of a 0.002 M solution in toluene; A2 (0.22 μmol) when used delivered as 733.3 μL of a 0.0003 M solution in toluene; B/M molar ratio = 1.1 when second activator was used; Toluene was used as the reactor solvent and delivered to the reactor for a total volume of 5 mL; reaction temperature, 40 °C; ethylene gauge pressure 7.07 atmospheres; Activators: A1 = tris(perfluorophenyl)boron, A2 = dimethylanilinium tetrakis(perfluorophenyl)borate, MAO = methylalumoxane, TMA = trimethyl aluminum.
*When Activator 2 was used, Activator 1 was the co-activator.

Table 13: Supported compound ethylene polymerizations (S-1, S-2) – Part A.

Run #	Support	Support Used (g)	Activator 10 wt%	Activator (ml)	Time (hr)	Polymer (g)	Activity
390[1]	S-1	0.70	MAO	1.3	0.01	15.1	31,634
391[2]	S-1	0.35	MAO	0.65	0.01	15.9	33,378
392	S-1	0.15	MAO	0.28	0.25	8.1	1,930
393	S-1	0.15	MAO	0.28	0.25	8.7	2,046
394	S-2	0.15	MAO	0.28	0.25	14.5	3,477
395	S-2	0.15	MAO	0.28	0.25	4.9	1,184
396	S-2	0.15	MAO	0.28	0.25	3.4	803

1. The reactor was shut down after 22 seconds because of a 12 °C exotherm.
2. The reactor was shut down after 44 seconds because of a 12 °C exotherm.

Table 14: Supported compound ethylene polymerizations (S-1, S-2) – Part B.

Run #	MW	Mn	MWD	Branching	Vinylenes	Trisubs	Vinyls	Vinylidenes
390	-	-	-	-	-	-	-	-
391	-	-	-	-	-	-	-	-
392	108,954	41,572	2.6	4.8	0.03	0.02	0.30	0
393	109,495	42,238	2.6	4.7	0.05	0.02	0.22	0
394	114,864	41,287	2.8	4.9	0.05	0.01	0.30	0
395	119,251	40,109	3.0	4.5	0.02	0.02	0.29	0
396	126,662	37,059	3.4	4.2	0.03	0.06	0.26	0

Table 15: Additional ethylene polymerizations (Ni-1, Ni-2, Ni-3, Ni-8, S-2) with MAO or MAO/A1 – Part A

Run#	TMC	μmol TMC	Toluene (mL)	Activator[1] (molar Al/M or B/M)	C_2H_4 (atm)[3]	T (°C)	Time (hr)	Polymer (g)
397	Ni-1	1.53	150	MAO (1000)	3.40	80	1.0	0.17
398	Ni-1	15.3	150	MAO (1000)	34.03	80	0.5	15.0
399	Ni-1	15.3	150	MAO (50) + A1 (40)	34.03	80	0.5	14.5
400	Ni-3	14.0	150	MAO (1000)	3.40	80	0.5	0.404
401	Ni-3	14.0	150	MAO (1000)	34.03	80	0.5	9.0
402	Ni-2	13.8	150	MAO (1000)	3.40	80	0.5	1.18
403	Ni-2	13.8	150	MAO (1000)	34.03	80	0.5	9.4
404	Ni-8	5.0	25	MMAO (1000)	8.17	40	20.0	2.56
405[2]	S-2	5.0	25	MMAO (1000)	8.17	40	20.0	1.8
C49	---	---	25	MMAO (1000)	8.17	40	20.0	0.53

1. MAO = 30 wt % methylalumoxane; MMAO = 7 wt % modified methylalumoxane; A1 = tris(perfluorophenyl)boron.
2. S-2 loading of 16.6 μmol Ni-1 / g silica; polymer yield corrected for residual silica.
3. Measured as gauge pressure.

Table 16: Additional ethylene polymerizations (Ni-1, Ni-2, Ni-3, Ni-8, S-2 with MAO or MAO/A1 – Part B

Run#	Mw	Mn	MWD[1]	Tm (°C)[2]
397	112,710	10,400	10.8 (bimodal)	132.4
398	53,980	14,030	3.85 (bimodal)	114.5 (broad)
399[3]	56,340	8,420	6.69	116.1 (low-T sh)
400	76,070	9,620	7.91 (low-Mn sh)	128.6
401	61,980	12,940	4.79	118.0 (low-T sh)
402	45,360	6,580	6.89 (high-Mn sh)	128.0
403	76,680	13,560	5.66	106.6, 124.9
404	53,310	15,210	3.51	105.7, 123.5 (weak)
405	113,680	23,550	4.82	114.5 (low-T sh, weak)
C49	29,420	12,930	2.27	131.2

1. low-Mn sh = shoulder on the low Mn side of the Mn; high-Mn sh = shoulder on the high Mn side of the Mn.
2. low-T sh = shoulder on the low temperature side of the Tm.
3. Branching by ^{13}C NMR was measured for example **399**; the numbers are reported as branches per 1000C: 22.9 C_1, 4.2 C_2, 1.5 C_3, 4.8 C_4^+; olefin end-groups by ^1H NMR were determined for example **399** and are reported as relative mol %: 54.7 % vinyl : 45.3 % vinylene.

Table 17: Ethylene polymerizations carried out in the presence of cyclohexene (Ni-1, Ni-2, Ni-3, Ni-8, Ni-Br with MAO[1]) – Part A

Run#	TMC	μmol TMC	Toluene (mL)	Al/M molar	cH[2] (mmol)	C_2H_4 (atm)[3]	T (°C)	Time (hr)	Polymer (g)
406	Ni-1	15.3	150	1000	48.7	6.81	80	1.0	5.0
407	Ni-1	15.3	150	1000	48.7	34.03	80	1.0	10.3

408	Ni-3	14.0	150	1000	48.7	6.81	80	1.0	6.1
409	Ni-3	14.0	150	1000	48.7	34.03	80	1.0	6.34
410	Ni-3	14.0	150	1000	24.3	34.03	80	1.0	17.0
411	Ni-2	13.8	150	1000	48.7	6.81	80	1.0	4.0
412	Ni-2	13.8	150	1000	48.7	34.03	80	1.0	10.3
413	Ni-8	5.0	25	1000	10.0	8.17	40	20.0	2.81
C50	Ni-Br	16.8	150	1000	48.7	6.81	80	1.0	3.61
C51	Ni-Br	16.8	150	1000	48.7	34.03	80	1.0	2.84

1. MAO = 30 wt % methylalumoxane.
2. cH = cyclohexene.
3. Measured as gauge pressure.

Table 18: Ethylene polymerizations carried out in the presence of cyclohexene (Ni-1, Ni-2, Ni-3, Ni-8, Ni-Br with MAO) – Part B

Run #	Mw	Mn	MWD	Tm (°C)[1]	$C_1 : C_2 : C_3 : C_4^+$: 33.5 ppm CH units / 1000 C[2]	mol% distribution of vinyl:vinylene:trisubs[2] (total olefins/1000 C)
406	51,240	17,240	2.97	111.1 (low-T sh)	31.5 : 3.7 : 2.0 : 7.5 : 5.0	50.0 : 50.0 : 0 (0.6)
407	64,400	21,040	3.06	118.6 (low-T sh)	18.8 : 3.6 : 0.8 : 3.5 : 6.0	62.3 : 37.7 : 0 (0.6)
408	41,020	16,370	2.51	110.8 (low-T sh)	35.8 : 4.1 : 2.2 : 8.4 : 4.8	27.8 : 49.4 : 22.8 (0.7)
409	80,330	19,660	4.09	123.0 (low-T sh)	21.2 : 3.1 : 1.1 : 4.4 : 4.6	ND : ND : ND (0)
410	76,330	13,140	5.81	101.5, 119.4 (broad)	25.9 : 4.2 : 1.7 : 7.8 : 5.8	ND : ND : ND (ND)
411	48,540	15,540	3.12	116.6 (low-T sh)	26.2 : 4.1 : 1.0 : 7.4 : 9.4	37.3 : 60.0 : 2.7 (0.7)
412	64,690	12,810	5.05	119.7 (low-T sh)	22.0 : 3.0 : 1.1 : 4.1 : 8.4	55.1 : 42.0 : 2.9 (0.7)
413	157,520	35,160	4.48	121.3 (broad)	12 : 1 : < 1 : < 1 : ND	ND : ND : ND (ND)
C50	55,030	24,850	2.21	94.6 (broad)	21.4 : 2.3 : 1.1 : 4.0 : 4.0	56.1 : 43.9 : 0 (0.5)
C51	99,050	27,230	3.64	126.5 (low-T sh) (1^{st}ht 114.6, 127.6)	7.4 : 1.0 : 0.2 : 1.4 : 1.0	76.0 : 24.0 : 0 (0.5)

1. low-T sh = shoulder on the low temperature side of the Tm. For example **C51**, the first DSC heat showed multiple melt peaks that condensed to one on the second heat.
2. ND = not determined.

Table 19. Ethylene / cyclopentene copolymerization examples (Ni-6, Ni-8, Ni-9, S-2 with MAO or TMA/A1 – Part A

Run#	TMC	µmol TMC	Toluene (mL)	Activator[1] (molar Al/M or B/M)	cP[3] (mmol)	C_2H_4 (atm)[4]	T (°C)	Time (hr)	Polymer (g)
414	Ni-6	5.0	25	MAO (1000)	10.0	8.17	60	20.0	0.950
415[2]	S-2	5.0	25	MAO (1000)	10.0	8.17	60	20.0	0.641
416	Ni-8	5.0	25	MAO (1000)	10.0	8.17	60	20.0	0.870
417	Ni-9	5.0	25	MAO (1000)	10.0	8.17	60	20.0	2.80
C52	---	---	25	MAO (5 mmol)	10.0	8.17	60	20.0	0.510
418	Ni-6	5.0	25	TMA (50) + A1 (1.1)	10.0	8.17	60	20.0	0.005
419	Ni-9	5.0	25	TMA (50) + A1 (1.1)	10.0	8.17	60	20.0	0.750
C53	---	---	25	TMA (250 µmol) + A1 (5.5 mmol)	10.0	8.17	60	20.0	0

1. MAO = 30 wt % methylalumoxane; TMA = trimethyl aluminum; A1 = tris(perfluorophenyl)boron.
2. S-2 loading of 16.6 μmol Ni-1/ g silica; polymer yield corrected for residual silica.
3. cP = cyclopentene.
4. Measured as gauge pressure.

Table 20. Ethylene / cyclopentene copolymerization examples (Ni-6, Ni-8, Ni-9, S-2 with MAO or TMA/A1 – Part B

Run#	Mw[1]	Mn[1]	MWD[1]	Tm (°C)[2]	Mol % cP[2,3]	$C_1 : C_2 : C_3 : C_4^+$ / 1000 C[2]
414	22,010 *468,060*	6,550 *351,760*	3.36 *1.33*	127.2, 113.0 (low-T sh)	2.5	14.7 : 1.4 : 0.7 : 0.7
415	36,400 *537,910*	17,140 *296,300*	2.09 *1.82*	130.0	0.6	15.9 : 1.9 : 0.6 : 0
416	42,600 *604,460*	16,340 *441,060*	2.61 *1.37*	127.9 (1st ht 112.8, 128.6)	1.1	20.8 : 3.0 : 1.7 : 6.3
417	74,780	32,080	2.33	92.0	0.7	34.0 : 3.0 : 2.4 : 3.6
C52	678,770	400,550	1.70	131.9	0.0	ND
418	ND	ND	ND	ND	ND	ND
419	3,030 *40,200*	1,560 *24,000*	1.94 *1.68*	77.0, 94.6 (v br)	0.5	25.4 : 4.5 : 1.5 : 11.7[4]
C53	-----	-----	-----	-----	-----	-----

1. Bimodal; values in italics correspond to the second component. For examples **414**, **416**, and **419**, this represents a minor portion of the material; for example **415**, the two components were comparable. For example **419**, the lower-MW component was itself bimodal in nature.
2. ND = not determined; low-T sh = shoulder on the low temperature side of the Tm; v br = very broad. For example **416**, the first DSC heat showed multiple melt peaks that condensed to one on the second heat.
3. cP = cyclopentene; incorporation in the polymer backbone was measured as 1,3-enchained units.
4. 1.2 C_4 branches via the $-CH_2CH_2\underline{C}H_2CH_3$ ($2B_4$ CH_2) ^{13}C NMR resonance at 23.4 ppm, and 10.5 C_5^+ branches via the $-\underline{C}H_2CH_2CH_3$ ^{13}C NMR (2s CH_2) resonance at 22.6 ppm; 6.4 vinyls / 1000 C (^1H NMR).

Table 21. Norbornene polymerization examples (Ni-6, Ni-8, Ni-9, Ni-10 with MAO or TMA/A1 – Part A.

Run#	TMC	μmol TMC	Toluene (mL)	Activator[1] (molar Al/M or B/M)	NB[2] (mmol)	T (°C)[3]	Time (hr)	Polymer (g)
420	Ni-6	5.7	3.0	MAO (975)	14.4	RT	64.5	1.252
421	Ni-6	5.0	7.0	MAO (1140)	14.4	RT	16.0	0.963
422	Ni-9	5.3	3.0	MAO (1075)	13.7	RT	64.5	0.925
423	Ni-9	5.2	7.0	MAO (1062)	14.6	RT	16.0	0.314
424	Ni-10	5.1	7.0	MAO (1118)	14.1	RT	16.0	0.641
C54	---	---	3.0	MAO (5.7 mmol)	14.7	RT	16.25	0.038

C55	---	---	7.0	MAO (5.71 mmol)	14.7	RT	16.0	0.096
425	Ni-6	5.0	7.5	TMA (50) + A1 (1.1)	14.4	RT	16.0	0.980
426	Ni-8	5.0	7.5	TMA (50) + A1 (1.1)	14.4	RT	16.0	0.250
C56	---	---	7.5	TMA (250 μmol) + A1 (5.5 mmol)	14.4	RT	16.0	0

1. MAO = 30 wt % methylalumoxane; TMA = trimethyl aluminum; A1 = tris(perfluorophenyl)boron.
2. NB = norbornene
3. RT = room temperature (no thermal control).

Table 22. Norbornene polymerization examples (Ni-6, Ni-8, Ni-9, Ni-10 with MAO or TMA/A1 – Part B.

Run#	Mw	Mn	MWD
420	1,312,200	548,900	2.39
421[1]	1,677,490	929,150	1.81
422	1,633,560	949,750	1.72
423	2,180,840	1,425,260	1.53
424	2,072,040	1,287,670	1.61
C54	1,952,850	1,283,150	1.52
C55	2,284,570	1,562,250	1.46
425[2]	337,600	170,190	1.98
426[2]	456,620	199,800	2.29
C56	-----	-----	-----

1. No Tg or Tm observed (– 110 to 150 °C). ^{13}C NMR (1,1,2,2-tetrachloroethane-d_2, 120 °C): δ 53.1, 52.3, 51.8, 51.1, 49.0, 48.6, 48.0, 47.4 (2 C, main chain CH), 44.6, 43.3, 42.3, 41.5, 40.2, 39.9, 39.0, 38.8 (2 C, ring CH), 37.9, 35.5 (1 C, ring bridge CH$\underline{C}H_2$CH), 31.9, 30.6 (2 C, ring CH_2) ppm. ^{1}H NMR (1,2-dichlorobenzene-d_4, 120 °C): δ 2.43, 2.33, 2.21, 1.90, 1.58, 1.25, 1.15 ppm.
2. Also examined by ^{13}C NMR; appeared to have higher syndiotacticity than polymer from example **421** as measured by (larger rr and mr resonances at 40 – 42 ppm and smaller mm resonances at 38 – 40 ppm (Wu, Q.; Lu, Y. *J. Polym. Sci., Polym. Chem. Ed.* **2002**, *40*, 1421).

While certain representative embodiments and details have been shown to illustrate the invention, it will be apparent to skilled artisans that various process and product changes from those disclosed in this application may be made without departing from this invention's scope, which the appended claims define.

All cited patents, test procedures, priority documents, and other cited documents are fully incorporated by reference to the extent that this material is

consistent with this specification and for all jurisdictions in which such incorporation is permitted.

Certain features of the present invention are described in terms of a set of numerical upper limits and a set of numerical lower limits. This specification discloses all ranges formed by any combination of these limits. All combinations of these limits are within the scope of the invention unless otherwise indicated.